SOIL SURVEY

Haywood County North Carolina

Series 1940, No. 11

Issued January 1954

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with the
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
and the
TENNESSEE VALLEY AUTHORITY

How To Use THE SOIL SURVEY REPORT

FARMERS who have lived in one locality for a long time come to know about the soil differences on their own farms and on those of their immediate neighbors. What they do not know, unless a soil survey has been made, is how nearly their soils are like those at experiment stations or in other localities from which higher yields are reported. They do not know whether these higher yields are from soils like their own or from soils so different that they could not hope to get equally high returns, even if they adopted the practices followed in these other places. These similarities and differences among soils are known only after a map of the soils has been made. Knowing what kind of soil one has and comparing it with soils on which new developments have proved successful will remove some of the risk in trying new methods and varieties.

SOILS OF A PARTICULAR FARM

To find what soils are on any farm or other land, locate the tract on the soil map, which is in the envelope inside the back cover. This is easily done by finding the locality the farm is known to be in and locating its boundaries by such landmarks as roads, streams, and villages.

Each kind of soil is marked with a symbol on the map; for example, all soils marked **Mlo** are of the same kind. To find the name of the soils so marked, look at the legend printed near the margin of the map and find **Mlo**. The color in which the symbol appears in the legend will be the same as that on which it appears on the map. The **Mlo** means Masada loam, rolling phase. A section of this report tells what Masada loam, rolling phase, is like, for what it is mainly used, and some of the uses to which it is suited.

How productive is Masada loam, rolling phase? Find this soil name in the left-hand column of table 11, and note the yields of the different crops opposite it. This table also gives expectable yields for all the other soils mapped, so that the different soils can be compared.

Read in the section on Soil Types and Phases to learn what are good uses and management practices for this soil. Look also at the section headed Use, Management, and Productivity of the Soils. Here soils suited to about the same use and management practices are grouped. Find the group (see table 9) that contains Masada loam, rolling phase. What is said there about suitable crops, rotations, and erosion control applies to this soil.

SOILS OF THE COUNTY AS A WHOLE

If a general idea of the soils of the county is wanted, read the introductory part of the section on Soils. This tells where the principal kinds are found, what they are like, and how they are related to one another. Then study the soil map and notice how the different kinds of soils tend to be arranged in different localities. These patterns are likely to be associated with well-recognized differences in type of farming and land use.

A newcomer who considers purchasing a farm in the county will want to know about the climate as well as the soils; the types and sizes of farms; the principal farm products and how they are marketed; the kinds of farm tenure; kinds of farm buildings, equipment, and machinery; availability of schools, churches, hospitals, highways, railroads, telephone and electric services, and water supplies; industries; and cities, villages, and population characteristics. This information will be found in the sections on General Nature of the Area and on General Characteristics of Farming.

Students and others interested in how the soils of the county were formed and how they are related to the great soil groups of the world should read the section on Morphology and Genesis of Soils.

This publication on the soil survey of Haywood County, N. C., is a cooperative contribution from the—

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Series 1940, No. 11 Issued January 1954

SOIL SURVEY OF HAYWOOD COUNTY, NORTH CAROLINA[1]

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United States Department of Agriculture in cooperation with the North Carolina Agricultural Experiment Station and the Tennessee Valley Authority

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[2] The Division of Soil Survey was transferred to the Soil Conservation Service on November 15, 1952.

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HAYWOOD COUNTY is in the Blue Ridge province of the Appalachian Highlands. Cool summers and National park and forest areas attract many people. Although the agricultural areas are comparatively level, the county is predominantly hilly to steep, with a large part covered by high rugged mountains. Corn, wheat, rye, oats, hay, and forage are the main subsistence crops, and tobacco, cabbage, snap beans, and potatoes, the principal cash crops. Both beef and dairy cattle are raised. Timber and other industries supplement agriculture; in fact, one of the largest paper mills in the world is at Canton. The railroad and main highways provide excellent means of transporting products to outside markets. To provide a basis for the best agricultural uses of the land a cooperative soil research and mapping of the soils was made by the United States Department of Agriculture in cooperation with the North Carolina Agricultural Experi-

ment Station and the Tennessee Valley Authority. Field work was completed in 1940, and, unless otherwise specifically indicated, all statements in this report refer to conditions in the county at that time.

GENERAL NATURE OF THE AREA

LOCATION AND EXTENT

Haywood County is in the southwestern part of North Carolina (fig. 1), bordering Tennessee on the northwest. It has an area of 548 square miles, or 350,720 acres. Waynesville, the county seat, is 125 miles northwest of Charlotte, 160 miles southwest of Winston-Salem, and 245 miles west of Raleigh.

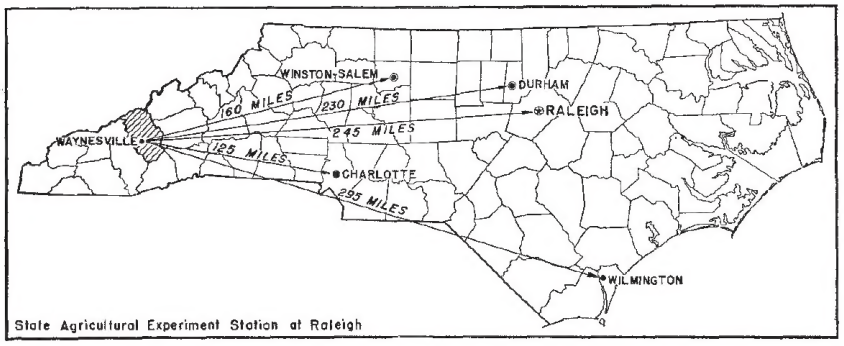

FIGURE 1.—Location of Haywood County in North Carolina.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

The county lies within the Blue Ridge province of the Appalachian Highlands (*3*).[3] This province comprises the belt of mountains west of the Piedmont province. The principal mountains are the Great Smoky, Snowbird, Balsam, Newfound, Whiteoak, Fork, and Cold Mountains; Pisgah, Lickstone, and Fork Ridges; Mount Sterling; and Shining Rock Ledge. The mountains have sharp crests, steep slopes, and spurs extending in all directions. In places near the bases and in coves the relief may be fairly level, but such areas are small and scattered throughout the county (pl. 1, *A*). Along the streams are strips or small bodies of almost level bottom land subject to overflow that range in width from a few feet to nearly one-third mile.

Elevations above sea level vary widely—the highest point, Mount Guyot, is 6,621 feet; the lowest, where the Pigeon River flows into Tennessee, is 1,400 feet. The elevations [4] of some of the better known mountains are: Waterrock Knob, 6,399 feet; Richland Balsam, 6,370; Black Mountain, 6,275; Jones Knob, 6,209; Plott Balsam, 6,200; Chestnut Bald, 6,000; Cold Mountain, 6,000; Mount Pisgah, 5,749; Lickstone Bald, 5,741; Sandymush Bald, 5,680; Tennessee Bald, 5,622;

[3] Italic numbers in parentheses refer to Literature Cited, p. 111.
[4] Data obtained from Coast and Geodetic Survey, U. S. Department of Commerce.

Mount Sterling, 5,600; Big Bald, 5,450; Soco Bald, 5,400; Crabtree Bald 5,280; and Green Knob, 5,150. Elevations of some of the towns and villages are as follows: Retreat, 2,800 feet; Waynesville, 2,638; Lake Junaluska, 2,594; Canton, 2,587; Cataloochee, 2,500; Clyde, 2,500; Crabtree, 2,482; and Waterville, 1,400.

The rolling, hilly, and mountainous relief gives the county moderate to very rapid natural drainage, although in some nearly level areas in first bottoms drainage is poor. Drainage is through the Pigeon River, which flows to the west and joins the French Broad River before it enters the Tennessee River, and Hominy Creek, which flows eastward into the French Broad River in Buncombe County. Tributaries of these and other creeks, branches, or small drainageways extend to all parts of the county, providing the uplands with complete surface drainage.

GEOLOGY

Most of the geologic formations in Haywood County are Cambrian or older. Carolina gneiss is the oldest of the formations, followed by Roan gneiss, Cambrian slate and shale, and Cranberry and Max Patch granites. There are a few dikes of diorite, gabbro, and similar rock.

Carolina gneiss (*11*) is Archean and occurs chiefly in the eastern part of the county. This formation consists of an immense series of interbedded mica and garnet schists and fine-grained granitoid layers. These rocks are usually light gray and weather to dull greenish gray.

Roan gneiss is Archean and can be found in the north-central part of the county adjoining Cranberry granite. It consists of an intricate series of hornblende schist and diorite with some interbedded mica schist and mica gneiss. The hornblende beds are dark green to black and the micaceous beds are dark gray.

Cambrian slate and shale occur west of Jonathans Creek, east of Hurricane Mountain, and in the southwestern part of the county. They are divided into several formations, the Snowbird, Hiwassee slate, Nantahala slate, and Great Smoky conglomerate. The Snowbird formation is composed mainly of fine- and coarse-grained quartzites, which are interstratified with conglomerate, arkose, and subordinate layers of gray and black slate. Some of the quartzites contain much feldspar in small grains; others have predominantly quartz grains. Most of the beds are light-colored, white or gray, but when they are considerably weathered, oxidation of the iron results in a rusty-brown or red color. The arkose beds lying at the base of the formation are either light gray or reddish, varying with the color of the feldspar fragments contained.

The Hiwassee slate formation consists almost entirely of bluish-gray or bluish-black slate that becomes greenish, yellowish gray, and yellow when weathered. Nantahala slate is composed of black and gray mica schist and ottrelite schist. Great Smoky conglomerate contains a considerable variety of strata, including conglomerate, quartzite, graywacke, mica schist, and slate. The original character of the beds is most noticeable in the conglomerate, which has layers ranging from 1 to 50 feet thick. On exposure all these light-gray rocks become whitish through weathering of the feldspar.

Max Patch and Cranberry granites occur in the northeastern part of the county, extending from near Sandymush Bald to the Tennessee State line where Haywood, Madison, and Cocke Counties join. Max Patch granite consists almost entirely of coarse granite that is porphyritic in places and uniformly grained in others. The minerals that compose the rock include orthoclase and plagioclase feldspars, quartz, biotite, and some muscovite. Accessory minerals include epidote, which is usually in secondary veins and patches, magnetite, and pyrite. Porphyritic crystals of orthoclase feldspar that are more than an inch long are common. In the porphyritic areas feldspar makes up the greater part of the rock, making it light gray or dull white. In the massive part of the formation biotite is prominent, giving it a decidedly spotted appearance because of the large size of the crystals.

The Cranberry granite formation is composed of granites of varying textures and colors, of schists, and of granitoid gneisses. The granites are igneous rocks formed from quartz, orthoclase and plagioclase feldspars, some biotite and muscovite micas, and, in places, some hornblende. Minor accessory minerals are magnetite, pyrite, ilmenite, garnet, and epidote. The most notable variation is in the size of the feldspar crystals. As the grain changes in size the granite changes from fine even-grained rock to light-gray or white rock of porphyritic appearance, which is more common in smaller areas of the formation and has feldspar as its most prominent mineral. Many of the narrow dikes penetrating the gneisses are light gray and predominantly feldspar. Near areas of Max Patch granite the feldspars of Cranberry granite are frequently filled with iron oxide, which gives the rock a markedly red tint. This variety is often characterized also by the presence of epidote in small veins and segregated masses.

CLIMATE

The humid and temperate climate of the county (*8*) is influenced by high altitudes. The moderately short cool summers have cool nights, days that are not sultry or very hot, and few dry seasons. Winters are generally cold but not severe, although short erratic spells of cold weather can be expected. Rainfall is plentiful, being adequately distributed throughout the growing season as well as the entire year. Local wide variations exist in mean annual temperature and precipitation because of the elevation differences. On the higher mountains precipitation is much heavier and the temperature considerably lower than in the valley areas. Snow often remains on some of the more elevated northern slopes during much of midwinter. Cover crops, as wheat, rye, and crimson clover, and a few hardy vegetables can be grown in winter at elevations below 3,000 feet. Outdoor work can be performed during most of the season.

The records of the United States Weather Bureau station at Waynesville represent the weather conditions in the valley sections of the county. In the more elevated parts of the county the frost-free season is shorter, temperature lower, and rainfall somewhat greater. The average frost-free season at Waynesville is 170 days, although killing frost has occurred as late as May 26 and as early as September 22.

The average number of clear days in Haywood County is 120 (*10*) and of cloudy days 110. The annual average number of days with snow cover is 30. Approximately 30 days have dense fog; 50 days, thunderstorms; and 1 or 2 days local hailstorms. The occasional droughty periods are seldom severe.

The normal monthly, seasonal, and annual temperature and precipitation, compiled from U. S. Weather Bureau records at Waynesville, representative of the valley areas of the county, and near Highlands, Macon County, N. C., representative of the mountainous districts, are given in table 1.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Waynesville, Haywood County, and near Highlands, Macon County, N. C.*

WAYNESVILLE, ELEVATION 2,756 FEET

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total for the driest year	Total for the wettest year	Average snowfall
	° F.	*° F.*	*° F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	38. 6	74	−5	4. 61	1. 08	12. 11	1. 8
January	38. 6	78	−12	3. 75	2. 55	6. 43	3. 7
February	38. 2	75	−10	4. 04	2. 15	7. 63	3. 9
Winter	38. 5	78	−12	12. 40	5. 78	26. 17	9. 4
March	46. 5	89	2	5. 05	5. 00	6. 19	1. 2
April	53. 5	89	15	3. 68	3. 15	. 86	0. 3
May	61. 6	91	29	3. 98	2. 00	2. 93	[1]
Spring	53. 9	91	2	12. 71	10. 15	9. 98	1. 5
June	68. 0	94	34	4. 12	2. 90	5. 87	0
July	70. 9	97	43	4. 60	2. 17	2. 63	0
August	70. 1	96	42	4. 21	3. 12	5. 39	0
Summer	69. 7	97	34	12. 93	8. 19	13. 89	0
September	65. 6	91	29	3. 00	. 39	4. 16	0
October	54. 7	86	14	3. 04	[1]	1. 29	. 3
November	45. 4	80	4	2. 25	2. 15	5. 10	1. 3
Fall	55. 2	91	4	8. 29	2. 54	10. 55	1. 6
Year	54. 3	97	−12	46. 33	[2] 26. 66	[3] 60. 59	12. 5

See footnotes at end of table.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Waynesville, Haywood County, and near Highlands, Macon County, N. C.*—Continued

HIGHLANDS, ELEVATION 3,350 FEET

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total for the driest year	Total for the wettest year	Average snowfall
	° *F.*	°*F.*	°*F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	40. 9	69	−10	8. 80	3. 29	14. 32	3. 0
January	39. 7	65	−14	6. 90	9. 12	13. 27	5. 3
February	40. 6	67	−19	6. 70	3. 72	12. 11	5. 6
Winter	40. 4	69	−19	22. 40	16. 13	39. 70	13. 9
March	45. 3	75	−7	8. 40	4. 06	5. 62	2. 5
April	53. 6	81	15	6. 40	3. 51	2. 71	1. 2
May	61. 1	84	26	6. 00	5. 36	8. 52	0
Spring	53. 3	84	−7	20. 80	12. 93	16. 85	3. 7
June	67. 9	87	32	7. 40	1. 90	15. 47	0
July	70. 5	87	39	8. 70	4. 64	2. 90	0
August	70. 1	85	40	7. 50	1. 02	7. 60	0
Summer	69. 5	87	32	23. 60	7. 56	25. 97	0
September	66. 3	84	27	6. 80	. 83	10. 36	0
October	55. 8	79	15	6. 30	8. 47	12. 30	. 1
November	46. 3	72	3	5. 00	7. 52	6. 02	. 4
Fall	56. 1	84	3	18. 10	16. 82	28. 68	. 5
Year	54. 8	87	−19	84. 90	[4] 53. 44	[5]111. 20	18. 1

[1] Trace.
[2] In 1904.
[3] In 1936.
[4] In 1925.
[5] In 1915.

WATER SUPPLY

In this mountainous county streams are numerous and good water is generally available. There are a few wells, but water for the majority of the rural population is supplied by springs. Three artificial lakes range in size from a few hundred to more than 1,000 acres. Lake Junaluska is used for recreational purposes; Lake Logan, as a reservoir and for recreational purposes; and Waterville Lake, built by an electric company, generates 93,000 horsepower (*6*). Undeveloped water power of the Pigeon River is estimated at 70,800 horsepower. At present only a few of the mountain streams afford good fishing, but some are being restocked.

VEGETATION

According to the classification of natural vegetation in the United States by Shantz and Zon (*7*), Haywood County lies within two subdivisions of the eastern forest region, namely, (1) birch-beech-maple-hemlock and (2) chestnut-chestnut oak-yellow poplar.

The original tree growth was chestnut, oak, hemlock, balsam, yellow-poplar, beech, birch, hickory, black walnut, sourwood, dogwood, black cherry, buckeye, red spruce, locust, and a few pine. Chestnut constituted possibly 50 percent of the original trees. Hemlock, yellow-poplar, red oak, and black locust were fairly common along streams, and ash, yellow-poplar, basswood, maple, blackgum, silverbell, black walnut, butternut, and some white and Virginia pines grew along the lower slopes. Varieties of hickory grew on the ridges; scarlet, red, and chestnut oaks and table-mountain pine were fairly abundant on the upper slopes; beech, birch, and sugar maple commonly thrived on the higher elevations (generally above 4,000 feet); and some balsam and spruce were on the tops and north slopes of the highest mountains. The undergrowth consisted mostly of dogwood, serviceberry, and mountain-laurel, together with rhododendron, which was more common at the higher elevations.

A large part of the original forest has been cut for timber. The chestnut trees were killed by blight between 1925 and 1932, but many of the dead trees are still standing and are being harvested for acid or extract wood. The present stand consists of second- and third-growth tuliptree (yellow-poplar), various oaks, maple, black locust, white and shortleaf pines, birch, and hickory, with much more pine and black locust than originally. Huckleberry, buckberry, and briers are prevalent in the undergrowth. Trailing arbutus and galax grow at the middle to higher elevations in the mountains.

Cultivated lands left idle and those abandoned soon grow up in weeds, broomsedge, and briers, and within 3 or 4 years white and shortleaf pines, locust, or yellow-poplar appear. Except on severely eroded areas, the tree growth is rather rapid, making a good stand within a few years. Since 1935 some of the land, chiefly severely eroded and gullied areas, has been reforested. In the Great Smoky Mountains National Park 1,100 seed-bearing plants, including 143 species of trees, have been recorded and 800 fungi and 300 mosses collected.[5]

ORGANIZATION AND POPULATION

When the white man first came to the land now comprising Haywood County, the Cherokee Indians possessed it. The county, named for John Haywood, State treasurer, was formed (*2*) from Buncombe County, December 23, 1808 (*1*), and included all the area now in Swain, Graham, Macon, Transylvania, and Jackson Counties. Waynesville, the county seat, was established in 1810 and named in honor of "Mad Anthony" Wayne, a general in the Revolutionary War. The first courthouse was built in 1812, and the present one in 1932.

The inhabitants are mostly descendants of the original settlers who came from Virginia and from other parts of North Carolina. These early settlers located along the Pigeon River and tilled the rich bottom

[5] Data on plants from Asheville (N. C.) Citizen, July 21, 1937.

soils. Later settlers occupied the bottom lands near smaller streams, especially Jonathan and Richland Creeks.

In 1950 the population was 37,631, of whom 10,201 were classed as urban and 27,430 as rural. The average density of rural population was 50.5 persons to the square mile. The population, however, is very unevenly distributed, being densest in the central part of the county along the Pigeon River. Because of the rough mountainous nature of much of the area, the population is limited almost exclusively to the valleys, particularly to areas near the larger streams. The northern, extreme western, and southern parts are the most sparsely populated.

Waynesville, a widely known summer resort, had a population of 5,295 in 1950; Canton, 4,906; Hazelwood, 1,769; and Clyde, 598. Small settlements are Cove Creek, Lake Junaluska, Dellwood, Woodrow, Cruso, Maggie, and Mount Sterling.

INDUSTRIES

A paper mill at Canton—one of the largest in the world—produces chemical pulp, paper, paperboard, tannic acid, solid caustic soda, adhesive extract, rosin soap and cleaner, and turpentine. This mill is a steady market for small and often otherwise unsalable timber. Some 20 sawmills, according to the North Carolina Department of Conservation and Development (*6*) and the State Forest Service, 1945, produce about 30 million board feet of lumber per annum. In addition to the lumber a considerable quantity of tanbark, pulpwood, and acid wood are produced.

A tannery at Hazelwood manufactures tannic acid and tans leather. A large plant producing tires and other rubber products is west of Hazelwood. Other plants located there manufacture furniture, upholstery, and wood novelties.

The economic minerals (*6*) are kaolin, clay, and mica. Near the Haywood-Buncombe County line north of Canton is a deposit of low-grade copper ore. Kyanite occurs in the vicinity of Crabtree. Commercial mica is found 1¼ miles north of Richland Balsam on the Waynesville watershed and at Big Ridge mine 4 miles southeast of Hazelwood. Near Woodrow, Hazelwood, and Clyde are good kaolin prospects.

Many of the men employed industrially live on small farms, where they grow crops mainly for home use in their spare time. Some farms, however, are larger and are operated on a greater scale, producing livestock and cash crops for market. Most of the industries have part-time employees, largely from farms, who in this way add to their farm income. Farmers in the county furnish a large part of the pulpwood, acid wood, and timber used by a local fiber company. The work of supplying these materials is done in winter, and it provides a source of extra income. Many persons find summer employment in local part-time industries and in hotels and resorts.

TRANSPORTATION AND MARKETS

The Asheville and Murphy branch of the Southern Railway System extends east to west across the county. It connects to a trunk line of the Southern Railway at Asheville and with the Louisville and Nashville Railroad at Murphy.

Seven main highways provide excellent means for transporting farm products to market. One of these, extending from Asheville to Atlanta, Ga., passes through the central part in a northeast-southwest direction. Others connect Waynesville with Hot Springs and the north; with Waterville and Newport, Tenn.; with Cherokee; and with Canton. From Waynesville a scenic road runs southeast through Pisgah National Forest to Brevard. The Blue Ridge Parkway extends partly around the county border. All of these routes, except parts of the Parkway, are open for travel throughout the year. Secondary roads and trails extend into all parts of the county. The public roads are good in summer, but some may be impassable to motor vehicles in winter.

Canton, Waynesville, Hazelwood, and Clyde are the principal local markets for farm products of the county. Clyde is the chief market for cattle, although many are sold in Asheville and a few are bought locally by outside traders. Most of the burley tobacco is sold in Asheville, but a little goes to markets in Tennessee. A few apples are sold locally, but most of them are bought at the orchards by outside dealers. A cooperative cannery is in Hazelwood. A creamery in Waynesville collects cream and milk on routes throughout the county, and some milk is sold to creameries in Asheville.

PUBLIC FACILITIES AND HOME AND FARM IMPROVEMENTS

Churches and schools are conveniently located, and all sections are served by school busses. Nine post offices, together with the rural routes, serve the entire area.

Many farmhouses are large and substantial, and a number have modern conveniences, as electric lights and running water. Telephone and electric services are available in some parts of the county. There were 2,784 farms in the county in 1950. In 1950, 558 farms had telephones; and 2,250 farms had electricity that came from a power line. Most of the tenant houses and many of the homes in remote mountain districts are small, and some of them are poorly suited to family needs.

Barns on most of the farms are fairly good and of sufficient size to supply necessary room for storing crops and housing stock. Many of the better farms, where winter feeding of cattle is practiced, have extra-large barns for storing hay and forage and a number of outbuildings for machinery. In 1950, 1,000 farms had 1,109 automobiles; 685 farms, 720 trucks; and 305 farms, 336 tractors. Most fences are made of barbed wire, but some are the old split-rail type and are still in satisfactory condition.

SOIL SURVEY METHODS AND DEFINITIONS

In making a soil survey the soils are examined, classified, and mapped in the field and their characteristics recorded, particularly in regard to the suitability for various crops, grasses, and trees.

The soils and underlying formations are examined systematically in many locations. Test pits are dug, borings made, and highway or railroad cuts and other exposures studied. Each reveals a series of distinct soil layers, or horizons, termed collectively the soil profile. Each horizon, as well as the underlying parent material, is studied in detail, and the color, structure, porosity, consistence, texture, and

content of organic matter, roots, gravel, and stone are noted. The chemical reaction of the soil and its content of lime and salts are determined by simple tests.[6] Other features taken into consideration are drainage, both internal and external, the relief, or lay of the land, and the interrelations of soil and vegetation.

The soils are classified according to their characteristics (4), both internal and external, with special emphasis upon the features that influence the adaptation of the land to the production of crop plants, grasses, and trees. On the basis of these characteristics, soils are grouped in the following classification units: (1) Series, (2) types, (3) phases, (4) complexes, and (5) miscellaneous land types.

The series is a group of soils having the same genetic horizons, similar in their important characteristics and arrangement in the soil profile and having similar parent material. Thus, the series is a group of soils having essentially the same color, structure, natural drainage, and other important internal characteristics and the same range in relief. The texture of the upper part of the soil, including that commonly plowed, may differ within a series. The series are given geographic names taken from localities near which they were first identified. Ashe, Congaree, Halewood, and Porters are names of important soil series in Haywood County.

Within a soil series are one or more soil types, defined according to the texture of the upper part of the soil. Thus, the class name of this texture—sand, loamy sand, sandy loam, loam, fine sandy loam, silt loam, clay loam, stony loam, or stony clay loam—is added to the series name to give a complete name to the soil type. Congaree silt loam and Congaree fine sandy loam are soil types within the Congaree series. Except for texture these types have approximately the same profile characteristics. The soil type, or where the soil type is subdivided, the soil phase is the principal unit of mapping. It is the unit or the kind of soil that is most nearly uniform and has the narrowest range of characteristics. For this reason land use and soil management practices can be more definitely specified for it than for broader groups of soils that contain more variation.

Some soil types are separated into two or more phases. For example, if a soil type has slopes that range from 2 to 15 percent, the type may be mapped in two phases, an undulating phase (2 to 7 percent slope) and a rolling phase (7 to 15 percent slope); or a soil that has been eroded in places may be mapped in two or more phases, an uneroded or normal phase (denoted by the name of the soil type only), an eroded phase, and perhaps a severely eroded phase. A soil type is broken into phases primarily because of differences in the soil other than those of kind, thickness, and arrangement of layers. The slope, the frequency of outcropping bedrock, the extent of erosion, or artificial drainage are examples of characteristics that cause a soil type to be divided into phases.

In some places, two or more soil units may be in such intimate or mixed pattern that they cannot be clearly shown separately on a small-scale map, but must be mapped as a complex. An example of a soil complex is Congaree-Toxaway silt loams.

[6] The reaction of the soil is its degree of acidity or alkalinity expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality; higher values, alkalinity; and lower values, acidity. Indicator solutions or electro-chemical methods are used to determine the chemical reaction.

Some areas of land that have little or no true soil are termed miscellaneous land types. Examples in this county are Rough gullied land (Halewood and Hayesville soil materials), Stony colluvium (Tusquitee soil material), and Stony rough land (Porters and Ramsey soil materials).

The soil surveyor traverses the entire area, examines borings, observes the landscape, and makes a map of the county or area showing the location and extent of each of the soil types, phases, complexes, and miscellaneous land types in relation to roads, houses, streams, lakes, and other local cultural and natural features of the landscape.

A glossary contained in this publication gives definitions of specific terms used in the report.

SOILS

GENERAL NATURE OF THE SOILS

The soils of Haywood County have been classified in 19 series, the external and internal characteristics and related features of which are given in table 2.

The soils of six series, Ashe, Porters, Ramsey, Burton, Tate, and Tusquitee, are common to the mountain uplands. Tate and Tusquitee soils are also common to the intermountain uplands. Mountain uplands are areas of high elevation, with long and generally steep slopes and narrow valleys; intermountain uplands are at relatively low elevations and have less steep but nevertheless strongly rolling to hilly relief and somewhat more open valleys.

Ashe soils have developed over light-colored granite and gneiss and have a light-brown or gray surface soil and a yellow to brownish-yellow relatively open and permeable subsoil. Although the relief is hilly to very steep and natural fertility is low, the less steep areas are suitable for agriculture and respond readily to good management.

Porters soils, developed over dark-colored granite, gneiss, and schist, have a brown or dark-brown surface soil and a brown to yellowish-brown relatively open and permeable subsoil. The relief is dominantly hilly to very steep, but natural fertility is moderately high (pl. 1, *B*). Chiefly because of their strong slopes, however, these soils are used principally for pasture and forest.

Ramsey soils, developed on steep slopes and over highly siliceous rock, have a gray to brownish-gray loam or stony loam surface soil and a yellow or brownish-yellow loam or clay loam poorly developed subsoil. The profile is generally shallow to bedrock. Largely because of steep relief and low fertility, the soils are poorly suited to crops and pasture and are best suited to forest. Under careful management some of the less steep areas could be used for pasture.

The Burton soil is distinguished by its dark surface soil, which is dark-gray to almost black stony loam containing much organic matter. The subsoil is light yellowish-brown to brown friable clay loam or loam. Most of the Burton areas are in elevated coves or on slopes facing north, and practically all of them are associated with Ashe, Porters, or Ramsey soils. The relief is strongly sloping to hilly, with only a few small steep areas. This soil is not well suited to crops because of the high elevation and presence of much stone but is capable of supporting a good grass cover and is well suited to grazing.

TABLE 2.—*Characteristics of soil series of Haywood Coun*

Soil series	Parent material	Relief	Drainage	Surface soil (A horizon)
MOUNTAIN UPLANDS				
Ashe	Residuum from—Granite and gneiss	Hilly to very steep.	Somewhat excessive to excessive.	Light-brown or gray fri loam or stony loam.
Porters	Granite, gneiss, and schist.	do	do	Brown or dark-brown fri loam or stony loam.
Ramsey	Conglomerate, slate, shale, and sandstone.	do	Moderate to excessive.	Gray to brownish-gray fri loam or stony loam.
Burton	Granite, gneiss, and schist.	Hilly	Slow to moderate.	Dark-gray to almost bl friable stony loam.
Tate [2]	Colluvium or local alluvium.	Rolling or sloping to hilly.	Moderate to somewhat excessive.	Brownish-gray friable loam or stony silt loam.
Tusquitee [2]	do	do	do	Dark-brown to brown fri loam or stony loam.
INTERMOUNTAIN UPLANDS				
Hayesville	Residuum from—Granite, gneiss, and schist.	Rolling or sloping to steep.	Moderate to excessive.	Brown to yellowish-br friable loam.
Halewood	do	do	do	Light-brown friable loam
Clifton	Dark basic igneous rocks.	Hilly to steep	do	Brown friable clay loam
Balfour	Granite and gneiss.	Rolling or sloping to hilly.	Moderate to somewhat excessive.	Grayish-brown friable loa

See footnotes at end of table.

TABLE 2.—*Characteristics of soil series of Haywood County, N.*

Soil series	Parent material	Relief	Drainage	Surface soil (A horizon)
HIGH STREAM TERRACES				
Hiwassee	Old alluvium	Undulating to hilly.	Moderate	Dark-brown or reddish-bro clay loam.
Masada	do	do	do	Light-brown friable loam
LOW STREAM TERRACES				
State	Moderately old alluvium.	Undulating to rolling.	Moderate	Light-brown to brown fria loam.
Altavista	do	Level to undulating.	Slow to moderate.	Yellowish-gray to gray fria silt loam or fine sandy lo
Warne	do	Level to sloping.	Slow	Gray friable silt loam
FIRST BOTTOMS				
Congaree	Recent alluvium	Nearly level	Moderate	Light-brown or brown fria fine sandy loam to silt lo
Toxaway	do	do	Very slow	Dark-gray to almost bl friable silt loam.
Wehadkee	do	do	do	Brownish-black friable sandy loam.
Buncombe	do	do	Excessive	Light-brown loamy fine sa

[1] Uneroded soil; with increased erosion the color and texture of this layer approach those of t
[2] Some soils of the series on intermountain uplands.

Tate soils, common to both mountain and intermountain uplands, are developed from colluvium or local alluvium composed of materials washed from adjacent areas of associated series. The surface soil is a brownish-gray loam, and the subsoil a brownish-yellow loose friable loam. These soils have rolling to hilly surface and, although medium low in natural fertility, respond well to good management and are suitable for truck crops, forage, and pasture.

Tusquitee soils are brown, fertile, and among the most suitable for agriculture in the county. They are also common to both mountain and intermountain uplands and are developed from colluvium or local alluvium consisting of materials washed from adjacent areas of associated series. Although soils of the associated series are developed in place over rock and vary chiefly because of differences in the parent rock, these differences are very greatly modified by the processes that form Tusquitee soils from the transported materials.

Soils of six series, Hayesville, Halewood, Clifton, Balfour, Tusquitee, and Tate, are common to the intermountain uplands. Tate and Tusquitee soils are also common to the mountain uplands and have already been described.

Hayesville soils, developed over light-colored granite, gneiss, or schist, have a brown to yellowish-brown surface soil and a brownish-red somewhat compact but brittle clay subsoil. They are rolling to steep and moderately fertile. Much of the less sloping land is suited to crops. Also developed over light-colored granite, gneiss, or schist are the Halewood soils, which resemble those of the Hayesville series, differing principally in having a less red and more friable subsoil.

Clifton soils, formed over dark-colored basic igneous or metamorphic rock, have a brown surface soil and a brownish-red clay subsoil. The relief ranges from hilly to steep. The soils are fairly high in natural fertility, and the less steep areas are moderately well suited to pasture and crops.

The Balfour soils, which have formed over light-colored granite and gneiss and to some extent schist, have a grayish-brown friable loam surface soil and a yellowish-brown to light reddish-brown friable clay loam subsoil. They occupy moderately fertile areas having rolling or hilly relief. The soils nearly everywhere are suited to crop production.

Soils of nine series—Hiwassee, Masada, State, Altavista, Warne, Congaree, Toxaway, Wehadkee, and Buncombe—are common to the stream terraces and first bottoms.

Hiwassee soils, developed from old alluvial material, have a dark-brown sticky clay loam surface soil and a brownish-red or red sticky clay subsoil. The alluvial material from which the soils were derived apparently was strongly influenced by dark-colored acidic and basic crystalline rocks. The soils occupy the highest positions on terraces and in most places overlie water-worn gravel, some pieces of which may be in the soil. Although productive of many of the crops grown in the county, the soils seem to be especially well suited to alfalfa, small grains, grass, and to a lesser degree, corn.

The Masada soils occur in association with the Hiwassee soils. They have a light-brown surface soil that is only slightly sticky when wet and a light reddish-brown subsoil, moderately sticky when wet. They

have developed from alluvial material apparently strongly influenced by acidic and basic crystalline rocks. In places a few water-worn pieces of gravel are on the surface or in the soil. The soils are well suited to the production of most of the crops grown in the county, including many truck crops.

State soils are on low terraces and are associated with the Altavista and Congaree series. They have a light-brown to brown friable loam surface soil and a yellowish-brown friable clay loam subsoil. Internal drainage is good. These soils are among the most productive of practically all of the crops grown in the county, being especially well suited to burley tobacco, corn, small grains, hay, and truck crops.

Altavista soils differ from Hiwassee and Masada soils in that they occur on lower terraces and have a yellowish-gray to gray fine sandy loam or silt loam surface soil and a yellow to brownish-yellow friable silty clay or sandy clay subsoil. The subsoil is only slightly sticky when moist. These soils are suited to the production of most of the crops commonly grown in the county and are highly prized for agricultural use. They have good tillage properties and respond readily to good management.

The Warne soil also occurs on lower terraces and is associated with the Altavista soils. This soil has a gray friable silt loam surface soil and a mottled gray and brownish-yellow silty clay to clay subsoil that is heavy, stiff, and plastic. The soil has poor internal drainage, is not well suited to many of the crops commonly grown, and is better used for hay and pasture. It is not very important agriculturally.

The Congaree soils occur on first bottoms. They have a light-brown or brown fine sandy loam or silt loam surface soil and a slightly heavier yellowish-brown or light-brown fine sandy loam or silty clay loam subsoil. Having favorable surface relief for cultivation, natural high fertility, and good internal drainage, these soils are highly prized for agricultural use, especially for corn, truck crops, and hay.

The Toxaway is the darkest colored soil of the bottom lands. The surface soil is a dark-gray to almost black organic loam or silt loam, and the subsoil is a very dark gray, grading into mottled gray and brown, heavy organic loam, silt loam, or silty clay loam. It is a rather poorly drained soil and is used chiefly for pasture. When adequately drained, it is excellent for corn, grass hay, and in places potatoes and other truck crops.

The Wehadkee is a low-lying soil on first bottoms. It has very poor drainage internally and externally and is subject to frequent overflow. The surface soil is a brownish-black fine sandy loam, and the subsoil is a gray, mottled with brown, heavy silt loam or silty clay loam. Largely because of poor drainage, use is restricted mainly to hay and pasture.

The Buncombe soil is associated on first bottoms with Congaree soils but is lower in natural fertility and more leached than Congaree soils. It is a light-brown friable loamy fine sand, which in some areas is yellowish brown below a depth of 8 to 20 inches.

SOIL TYPES AND PHASES

In the pages that follow, the soils, identified by the same symbols as those on the soil map, are described in detail and their agricultural relations discussed. Their location and distribution are shown on the

A, Landscape showing typical relief of Haywood County. Altavista soils predominate on the valley floor and steep Halewood and Porters soils and Stony rough land (Porters and Ramsey soil materials) in background.

B, Orchard on Porters loam, eroded steep phase; forest in background on Porters soils too steep or stony for orchards or pasture.

C, Moderately short rotations on Altavista silt loam; burley tobacco in foreground.

A, Corn growing on Buncombe loamy fine sand.
B, Strip cropping on Halewood loam, eroded hilly phase.
C, Corn growing on Hayesville clay loam, eroded rolling phase, under good management.

map in the envelope on page 3 of cover, and their acreage and proportionate extent are given in table 3. Their use suitability, present management and management requirements, estimated expectable crop yields, crop suitability, and fertilizer requirements are discussed in the section on Use, Management, and Productivity of the Soils.

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Haywood County, N. C.*

Soil	Acres	Percent
Altavista fine sandy loam	646	0.2
Altavista silt loam	857	.2
Ashe loam:		
Eroded steep phase	532	.2
Hilly phase	424	.1
Steep phase	2,632	.8
Ashe stony loam:		
Eroded hilly phase	137	(1)
Steep phase	8,941	2.6
Very steep phase	2,081	.6
Balfour loam:		
Eroded hilly phase	1,010	.3
Hilly phase	806	.2
Rolling phase	132	(1)
Buncombe loamy fine sand	1,327	.4
Burton stony loam	344	.1
Clifton clay loam:		
Eroded hilly phase	137	(1)
Eroded steep phase	150	(1)
Congaree fine sandy loam	1,777	.5
Congaree gravelly fine sandy loam	2,617	.7
Congaree silt loam	844	.2
Congaree-Toxaway silt loams	285	.1
Halewood clay loam:		
Severely eroded hilly phase	4,795	1.4
Severely eroded rolling phase	430	.1
Severely eroded steep phase	6,791	2.0
Halewood loam:		
Eroded hilly phase	7,648	2.2
Eroded rolling phase	1,579	.5
Eroded steep phase	13,086	3.7
Hilly phase	2,582	.7
Rolling phase	387	.1
Steep phase	10,587	3.0
Halewood stony clay loam, severely eroded steep phase	522	.1
Halewood stony loam:		
Eroded hilly phase	733	.2
Eroded steep phase	2,903	.8
Hilly phase	482	.1
Steep phase	8,756	2.5
Hayesville clay loam:		
Eroded hilly phase	2,364	0.7
Eroded rolling phase	364	.1
Eroded steep phase	436	.1
Severely eroded hilly phase	2,789	.8
Severely eroded rolling phase	239	.1
Severely eroded steep phase	1,178	.3
Hayesville loam:		
Hilly phase	923	.3
Rolling phase	255	.1
Steep phase	268	.1
Hiwassee clay loam:		
Eroded hilly phase	315	.1
Eroded rolling phase	455	.1
Made land	114	(1)
Masada clay loam:		
Eroded hilly phase	345	.1
Eroded rolling phase	398	.1
Masada loam:		
Rolling phase	338	.1
Undulating phase	443	.1
Porters loam:		
Eroded steep phase	7,707	2.2
Severely eroded steep phase	443	.1
Steep phase	20,769	5.9
Very steep phase	1,381	.4
Porters stony loam:		
Eroded hilly phase	514	.1
Eroded steep phase	1,857	.5
Hilly phase	424	.1
Steep phase	11,946	3.4
Very steep phase	7,086	2.0
Ramsey loam:		
Eroded hilly phase	959	.3
Eroded steep phase	4,021	1.2
Hilly phase	281	.1
Severely eroded steep phase	2,193	.6
Steep phase	8,168	2.3
Very steep phase	5,014	1.4
Ramsey stony loam:		
Eroded hilly phase	192	.1
Eroded steep phase	1,751	.5
Hilly phase	335	.1
Steep phase	13,705	4.0
Very steep phase	16,367	4.7

TABLE 3.—*Acreage and proportionate extent of the soils mapped in Haywood County, N. C.*—Continued

Soil	Acres	Per-cent	Soil	Acres	Per-cent
Rough gullied land (Halewood and Hayesville soil materials)	565	0. 2	Tate stony silt loam:		
State gravelly loam, undulating phase	363	. 1	Hilly phase	539	0. 2
State loam:			Rolling phase	620	. 2
Rolling phase	384	. 1	Toxaway silt loam	150	(1)
Undulating phase	977	. 3	Tusquitee loam:		
Stony colluvium (Tusquitee soil material)	5, 096	1. 5	Hilly phase	471	. 1
Stony rough land (Porters and Ramsey soil materials)	128, 258	36. 6	Rolling phase	2, 868	. 8
Tate silt loam:			Undulating phase	1, 435	. 4
Hilly phase	337	. 1	Tusquitee stony loam:		
Rolling phase	364	. 1	Eroded hilly phase	526	. 1
			Eroded rolling phase	299	. 1
			Hilly phase	1, 619	. 5
			Rolling phase	1, 979	. 6
			Warne silt loam	383	. 1
			Wehadkee fine sandy loam	190	. 1
			Total	350, 720	100. 0

[1] Less than 0.1 percent.

Altavista silt loam (Av)[7] (slope, 0 to 7 percent).—Areas of this level to gently sloping soil are associated with State, Warne, and Congaree soils on low terraces along the larger streams. The parent material was derived from upland soil material that overlaid igneous and metamorphic rocks. External drainage is slow to moderate and internal drainage moderate to slow. According to tests made of a number of samples, this soil is medium acid; low in magnesium, calcium, and phosphorus; and medium in content of potash and organic matter. Originally the soil had a hardwood forest cover, chiefly various oaks, hickory, and yellow-poplar, but now all areas are cleared.

The following profile was taken in a cultivated field:

0 to 8 inches, yellowish-gray to gray very friable silt loam.
8 to 23 inches, yellow to brownish-yellow friable to slightly sticky silty clay, which breaks into irregularly shaped lumps ranging from ¼ to ¾ inch in diameter and containing some finely divided mica flakes.
23 to 36 inches, mottled gray and yellow friable to slightly sticky silty clay, containing numerous finely divided mica flakes and underlain to a depth of many feet by mottled gray and yellow sand and clay mixed with gravel.

Variations occur in the quantity of gravel on the surface and in the soil; in external drainage of the more level areas, which is inclined to be very slow in places; and in degree of mottling of the lower subsoil, which may be quite pronounced in many places. Included because of small acreage are a few slightly eroded areas that have lost somewhat less than 25 percent of their original surface soil but have not been impaired very much for use.

Most of the areas of Altavista silt loam have been cleared and used for crops and pasture, the principal crops being corn, potatoes, and

[7] The symbols for the various soils correspond to those appearing on the soil map in the envelope on page 3 of cover.

green beans. The smooth relief, generally good drainage, good moisture relations, and the ability to respond to management make this soil desirable for agriculture. It may be used intensively for the production of row or intertilled crops and can be used in relatively short rotations, providing a cover crop is turned under at least once every 2 years (pl. 1, *C*).

Altavista fine sandy loam (Af) (slope, 2 to 7 percent).—The principal differences between the fine sandy loam and the silt loam are in the texture of the surface soil and in the somewhat more friable nature of both the surface soil and subsoil. The surface soil is usually gray or yellowish-gray friable fine sandy loam, and the subsoil, yellow to brownish-yellow friable fine sandy clay or fine sandy clay loam. External and internal drainage are moderate. The soil is medium acid; low in magnesium, calcium, and phosphorus; and medium in potash and organic matter. Until cleared for agricultural use, it supported a hardwood forest.

The most noticeable variations are in the texture and consistence of the subsoil, which may range from friable fine sandy loam to slightly sticky fine sandy clay. Included because of small acreage and similarity of profile are level areas that are generally more slowly drained externally than those with an undulating surface. A few areas, totaling about 188 acres, have lost probably less than 25 percent of the original surface soil, and a few very small areas have lost 25 to 75 percent of the surface soil by erosion. Special care needs to be taken to prevent further loss by erosion in these and other areas.

Altavista fine sandy loam is very desirable for general farming. Corn is grown on most of the soil, and small grains and hay crops are on much of the rest. It is well suited to practically all field crops and to many of the vegetables generally grown in the area. Under good management it may be used intensively in short rotations.

Ashe loam, steep phase (Amz) (slope, 30 to 60 percent).—This phase occupies mountain uplands underlain by light-colored granite, gneiss, and some schist and is associated with other Ashe soils, Porters soils, and Stony rough land (Porters and Ramsey soil materials). It is a relatively shallow soil, usually less than 3 feet to parent rock. External drainage is rapid and internal drainage moderate. Averages of a number of tests indicate that the soil is medium acid, low in calcium and magnesium, medium to low in phosphorus, and fairly high to low in potash. In uncleared areas it is medium high in organic matter, especially where there has been little or no burning. The forest cover is chiefly white, red, post, and chestnut oaks, maple, locust, serviceberry, dogwood, sourwood, and white pine with an undergrowth of mountain-laurel and rhododendron.

Following is a profile description:

0 to 8 inches, light-brown to gray friable porous loam.
8 to 30 inches, yellow or brownish-yellow very friable clay loam with an appreciable quantity of sharp angular quartz particles; medium-crumb structure.
30 inches +, disintegrated granite rocks.

Local variations occur in profile depth, which ranges from about 16 to 44 inches over bedrock; in the degree of profile development; and in the quantity of organic matter on the surface and in the surface layer. In places a few stones are on the surface or in the soil.

Chiefly because of its steep slopes, Ashe loam, steep phase, is not well suited to crops requiring tillage but when properly managed is capable of affording good to very good grazing. Most of the soil is still in forest.

Ashe loam, eroded steep phase (Amf) (slope, 30 to 60 percent).—This phase differs from the steep phase in having lost 25 to 75 percent of the original surface soil by accelerated erosion. In most areas the plow layer is light-brown to yellowish-gray friable loam (a mixture of surface and subsoil materials), and the subsoil is generally within plow depth. There are a few relatively shallow gullies. External drainage is rapid and internal drainage moderate. Where the soil has not been limed or heavily fertilized recently, it is medium to strongly acid, low in calcium and magnesium, medium to low in phosphorus, and fairly high to low in potash and in organic matter. The entire profile is readily permeable to roots and moisture.

Variations are chiefly in the degree of erosion and gullying and in the depth and development of the soil profile. A few areas have some stones on the surface and in the soil mass, but not enough to interfere with tillage operations or the growth of grass. Included with this moderately eroded soil are areas, totaling about 239 acres, of Ashe loam, severely eroded steep phase. These inclusions have lost more than 75 percent of the original surface soil and in places some of the upper part of the subsoil. Such areas are generally gullied, the gullies being crossable with farm implements but too deep to be obliterated by ordinary tillage practices.

All areas of Ashe loam, eroded steep phase, have at some time been cultivated but are now used mostly for pasture. On many farms, largely to control weeds, a clean-cultivated crop is grown occasionally and the land then reseeded to pasture. Pasture vegetation responds well to amendments, especially lime and phosphate. Because of the steep slopes the soil is poorly suited to tilled crops. Areas required for cultivation should be handled under long rotations consisting chiefly of close-growing hay crops and small grains.

Ashe loam, hilly phase (Aml) (slope, 15 to 30 percent).—Although this phase has the same profile characteristics as the steep phase, it has milder slopes and may be deeper to bedrock. When cleared and cultivated, it is not so susceptible to accelerated erosion because of its milder relief. Areas occur in association with other members of the Ashe series. External and internal drainage are moderate. The entire profile is medium to strongly acid. The quantities of available calcium, magnesium, phosphorus, and potash are about the same as in the steep phase of Ashe loam.

Variations occur in the quantity of organic matter in the surface soil and in the depth of the profile to bedrock. Included because of small acreage and similar profile are a few small areas, totaling about 54 acres, that have been farmed and have lost up to about 25 percent of the original surface soil by accelerated erosion. Other included areas, totaling about 130 acres, have lost 25 to 75 percent of the surface soil. Although the quantity of soil removed from these more eroded areas varies greatly, in average fields the plow layer is light brown (a mixture of surface and subsoil materials), and the subsoil is usually within plow depth. A few relatively shallow gullies are present in some areas.

Except on the eroded areas, Ashe loam, hilly phase, has a mixed hardwood forest. Many areas, if cleared, would be suited to most crops grown in the northern part of the county, but the hilly relief makes frequent planting of row crops inadvisable. Good management requires substantial applications of fertilizer and lime, relatively long rotations, and tillage practices that will minimize runoff.

Ashe stony loam, steep phase (Atz) (slope, 30 to 60 percent).—Areas of this phase occur in the more mountainous parts of the county. Largely because of the steep slopes, ease of erosion, stoniness, and low natural fertility, the soil is better suited to forest than to crops or pasture. It differs from Ashe loam, steep phase, chiefly in the degree of stoniness but in places also in depth to bedrock. Some rock outcrops and stones ranging from small rock fragments to boulders are present and are generally sufficient to interfere materially with agricultural operations. External drainage is rapid and internal drainage moderate. The reaction and the quantity of calcium, phosphorus, magnesium, potash, and organic matter present are about the same as for Ashe loam, steep phase.

The soil varies in the content and size of stones and in degree of profile development. Included because of similarity of profile are about 203 acres that have been cleared and used for crops or pasture and as a result are slightly eroded. Moderately eroded areas totaling about 130 acres also are included. The quantity of soil material removed by erosion varies considerably, but in average areas the plow layer is light-brown to gray friable loam consisting of a mixture of surface soil and subsoil material. A few shallow gullies have formed.

Ashe stony loam, eroded hilly phase (Ath) (slope, 15 to 30 percent).—This phase differs from the steep phase in having milder slopes and in being eroded. Areas are in the higher mountains in association with phases of the Porters and Ashe stony loams. Stones interfere with tillage, although the quantity varies from place to place. They range in size from very small rock fragments to large boulders, and locally there are small outcrops of bedrock. About 25 to 75 percent of the original surface soil has been removed by accelerated erosion, and the present surface soil is a brownish-yellow mixture of original surface soil and subsoil material. There are a few gullies that are crossable with farm machinery but cannot be obliterated by ordinary tillage operations. External drainage is moderate to rapid and internal drainage moderate. This phase varies from place to place in degree of erosion, stone content, and depth to bedrock. A forested area of about 10 acres that is not eroded to any appreciable extent is included.

Most areas of Ashe stony loam, eroded hilly phase, are used for crops or pasture. Chiefly because of eroded condition, hilly relief, and stoniness, the soil is not well suited to intertilled crops, but with adequate management it will produce good pasture. A good sod is necessary at all times for the protection of the soil.

Ashe stony loam, very steep phase (Atv) (slope, 60+ percent).—Rugged relief and degree of stoniness distinguish this soil from Ashe loam, steep phase. Like other Ashe stony soils, stones ranging in size from very small rock fragments to large boulders and small outcrops of bedrock are in sufficient quantities to interfere seriously with tillage operations. External drainage is rapid to very rapid and in-

ternal drainage moderate. Reaction and content of calcium, magnesium, phosphorus, potash, and organic matter are about the same as for Ashe loam, steep phase. Important variations are in content and size of stones and in depth to bedrock. Because of stoniness and rugged relief all the very steep phase is in forest, its best use.

Balfour loam, rolling phase (Blo) (slope, 7 to 15 percent).—This brown soil of the intermountain uplands is derived from granite, gneiss, or schist. In forested areas there is a thin surface layer of organic matter. The soil averages less than 36 inches in depth to bedrock, which is less than for some of the valley soils. Relief is sloping and external and internal drainage are moderate. Samples from a number of uncleared areas indicate the soil is medium acid, medium to low in calcium, low to very low in phosphorus, low to fairly high in potash, and medium high to high in organic matter. In most places the soil supports a dense growth of hardwood trees, the forest consisting of various oaks, yellow-poplar, hickory, a few black walnut, sourwood, birch, locust, silverbell, and serviceberry.

A profile description is as follows:

0 to 10 inches, grayish-brown friable loam, which is porous and permeable to roots, air, and water.
10 to 34 inches, yellowish-brown to light reddish-brown firm but friable clay loam permeable to roots, air, and water.
34 inches +, gray disintegrated and partly decomposed gneiss rock intermingled with soil material.

Variations are largely in the degree of profile development. In many places the typical color profile exists, but in others there is little difference in texture, consistence, and structure between the surface soil and the subsoil. In some places a few stones are on the surface and mixed with the soil material, generally not in sufficient quantities to interfere materially with tillage operations. Included because of small aggregate extent are areas totaling about 76 acres of moderately eroded land and about 13 acres of severely eroded land.

Balfour loam, rolling phase, would be well suited to tilled crops if cleared of forest. It is especially desirable for corn, hay, and some vegetable crops, as string beans, sweet corn, and potatoes. Where the air drainage is good, orchards would probably do well. Because of the favorable surface relief the soil could be used for moderately short crop rotations.

Balfour loam, hilly phase (Bll) (slope, 15 to 30 percent).—This soil differs from the rolling phase chiefly in having a steeper relief. External drainage is moderate to rapid and internal drainage moderate. The tree growth, reaction, and content of plant nutrients are about the same as for the rolling phase. The soil occurs in the valley sections and on the smoother slopes of the low mountains.

Variations occur mainly in degree of profile development and depth of profile to bedrock. Some areas have a good color profile, but there is little difference between the texture and consistence of surface soil and subsoil. A few stones are on the surface or in the soil mass in places, but there are generally not enough to affect tillage operations seriously. Some few areas contain more mica than is generally found in Balfour soils, and in these the subsoil generally has a somewhat greasy feel. Included with the hilly phase because of similar profile are areas totaling about 225 acres that have been cleared of the forest

cover, cultivated for some time, and have lost up to 25 percent of the original surface soil.

Balfour loam, hilly phase, if cleared, would be well suited to small grains and hay, but its strong slope makes it less well suited to row crops. Strip rotating should be practiced if the soil is cleared for tilled crops, since under this management only a part of an area would be plowed at any one time. The soil is very good to excellent for pasture.

Balfour loam, eroded hilly phase (Blh) (slope, 15 to 30 percent).—Areas of this phase are in the valley sections and on the smoother areas of the low mountains. The soil differs from the rolling phase in relief and in being moderately eroded. From 25 to 75 percent of the original surface soil has been removed by accelerated erosion. Although the quantity of material lost varies greatly, in average areas the subsoil generally is within plow depth and the plow layer is composed of a mixture of the original surface soil and some subsoil. Owing to this mixing, the surface soil is somewhat lighter in color and has a slightly heavier consistence in places. There are a few gullies, but most of them are crossable with farm machinery. External drainage is rapid and internal drainage moderate. Where heavy applications of fertilizer and lime have not been made in recent years the soil reaction is about the same as that of Balfour loam, rolling phase, but the content of plant nutrients is lower. The soil is permeable to roots, air, and water.

Variations are in the degree of erosion, extent of profile development, and depth to bedrock. In some places a few stones are on the surface or mixed with the soil but do not interfere materially with tillage operations. Included because of somewhat similar characteristics and small extent are about 33 acres of Balfour loam, hilly phase, that have been severely eroded and have lost more than 75 percent of the original surface soil and in places some of the subsoil. In a few localities the soil is more micaceous than normal and has a slightly slick feel when rubbed between the fingers.

Nearly all areas of Balfour loam, eroded hilly phase, are used for tilled crops or for pasture. Although the soil has become moderately eroded through improper management, it is well suited to the growth of small grains, sod-forming crops, and pasture. When this phase is used for clean-tilled crops, a rotation of strips following the contour should be used, so that only a small part of a field is plowed at any one time; otherwise some other good practices for control of runoff and erosion should be practiced.

Buncombe loamy fine sand (Bf) (slope, 0 to 2 percent).—This level or nearly level soil of the first bottoms has formed from alluvial material derived from uplands underlain mainly by light-colored gneiss, granite, or schist. Areas are generally between the stream channels and the other bottom-land soils, and many are in the outside bends of streams where overflows are more frequent and damage from swiftly moving waters may be great. External drainage is moderate and internal drainage very rapid. The soil is strongly acid and very low in organic matter. Wooded areas support a fair to good growth of ash, willow, and other moisture-loving hardwood trees.

Following is a profile description:

0 to 9 inches, light-brown loose loamy fine sand.
9 to 35 inches +, yellowish-brown loose loamy fine sand having many finely divided mica flakes and underlain by alluvial material of sandy loam to clay loam texture and mottled gray and brown color.

Textures of the surface soil and subsoil show slight variation—they range from fine or medium sand to loamy sand over loose loamy sand or sand subsoil. In many stream bends the relief is almost hummocky, a condition brought about by swiftly flowing floodwaters.

Although Buncombe loamy fine sand is inherently less fertile than the members of the Congaree series with which it is associated, and is subject to severe leaching, it is used for truck crops, corn, hay, and winter grazing (pl. 2, *A*). It is easily tilled, and many areas can be improved considerably by the addition of green-manure crops. With heavy fertilization, yields comparable to those on Congaree fine sandy loam are sometimes possible. Crops, however, are often damaged by flooding and their total destruction is not uncommon. The high fertility that may have been obtained over a period of years by the use of organic matter and suitable fertilizers can be destroyed by a single flood.

Burton stony loam (Bs) (slope, 7 to 30 percent).—This hilly soil has developed over granite, gneiss, or schist on the tops of and in north-facing coves of some of the higher mountains, in many places on balds having predominantly grass or shrub cover. External drainage is slow to moderate and internal drainage is moderate, except in a few small draws at the head of some drainageways or around springs, where it is slow because of seepage water. The soil is permeable to roots and moisture and high in organic matter. Averages of several tests indicate that it is very strongly acid, very low in calcium, magnesium, and phosphorus, and low in potash. Surface stones, ranging from pebbles to large boulders, are numerous enough in most places to interfere with tillage operations, and there are a few small rock outcrops.

A profile description is as follows:

0 to 18 inches, dark-gray to almost black friable loam, very high in organic matter and almost like muck; contains many small roots.
18 to 28 inches, light yellowish-brown to brown friable porous clay or clay loam.
28 inches +, loose rock, with some material filling the space between rocks.

Variations occur in the depth of the 8- to 24-inch dark surface layer and in the quantity and size of the stones.

Owing to high elevation, short growing season, and stoniness Burton stony loam is not well suited to crops generally grown in the county. The growth of tilled crops would require much hand labor because of stones. The land is very well suited to pasture grasses, however, and is sometimes referred to as natural grassland.

Clifton clay loam, eroded hilly phase (Cch) (slope, 15 to 30 percent).—A hilly soil of the intermountain uplands developed over hornblende schist and gneiss. This phase has lost 25 to 75 percent of the original surface soil by accelerated erosion. Before erosion, the soil of the area now occupied by this phase was of the Clifton loam type. The quantity of material lost varies greatly but in represent-

ative areas the subsoil is within plow depth. External drainage is moderate to rapid and internal drainage moderate to slow. The entire profile is strongly acid.

Following is a profile description:

0 to 5 inches, brown to reddish-brown sticky to slightly plastic clay loam.
5 to 20 inches, brownish-red moderately compact or rather stiff clay loam or clay.
20 to 30 inches, light brownish-red clay loam or clay; firm but friable; partly disintegrated hornblende schist or gneiss below this layer.

The few stones throughout the profile are not sufficiently abundant to interfere materially with tillage. In places, chiefly on the more exposed parts of the slopes, practically all the surface soil has been lost and the plow layer consists of subsoil material. In some other places erosion has been much less than is typical of this soil, and here the surface layer is brown friable loam.

A very small acreage of Rabun clay loam, eroded phase, is included, which has a darker red color and a somewhat heavier consistence than Clifton clay loam, eroded hilly phase. No Rabun clay loam, eroded phase, is mapped separately in the county.

Nearly all of Clifton clay loam, eroded hilly phase, has been cleared of forest and is now used for crops and pasture. The soil is higher in fertility than the Ashe soils, but in general is deficient in calcium, phosphorus, potash, and organic matter. It is relatively permeable to roots and moisture and responds well to proper management. This phase is well suited to small grains and clovers and grasses for hay and grazing, but chiefly because of strong slope, moderately low fertility, and susceptibility to runoff is rather exacting in its management requirements. Most of the few gullies are crossable with farm machinery and could be eliminated by practical methods.

Clifton clay loam, eroded steep phase (Ccf) (slope, 30 to 60 percent).—This soil consists of areas of the steep phase that have lost 25 to 75 percent of the original surface soil by erosion. In representative areas the subsoil generally is within plow depth, and the plow layer, composed of a mixture of the original surface soil and subsoil, is moderate-brown clay loam. Because of the greater slope the soil is more susceptible to erosion than the eroded hilly phase. There are a few gullies that are crossable with farm machinery. External drainage is rapid to very rapid and internal drainage moderate to slow. Tests show this phase is medium acid where it has not been limed recently, and is low to very low in calcium and magnesium. Where it has not been fertilized heavily, it is low in phosphorus, medium to very low in potash, and low to very low in organic matter.

This eroded steep phase varies in degree of profile development, depth to bedrock, and in quantity of stones on the surface and in the soil mass. Included because of small extent are areas totaling about 9 acres that have lost less than 25 percent of the original surface soil and about 49 acres that are still in forest and have not been eroded to any appreciable extent. Also included are a few areas of the Rabun series, which have a brownish-red heavy clay loam surface soil that is friable when moist or dry but slightly sticky when wet and a reddish-brown heavy clay subsoil that is sticky when wet but friable and somewhat brittle when dry. There are about 18 acres of this soil in forested land not eroded to any extent, 3 acres that have lost less than

25 percent of the original surface soil, and 19 acres that have been moderately eroded. All areas of the included Rabun have a slope range of 30 to 60 percent.

Because of the steep slopes and eroded condition, this eroded steep phase of Clifton clay loam is unsuitable for clean-tilled crops, but under careful management it will produce good pasture. The pasture should not be overgrazed, and cattle should be removed when the soil is very wet, since the soil tends to puddle and then bake if trampled when wet.

Congaree fine sandy loam (Cf) (slope, 0 to 2 percent).—This young soil of the first bottoms formed from alluvial material derived from upland soils underlain mainly by light-colored gneiss, granite, or schist. Areas are associated with other Congaree soils and with Wehadkee, Altavista, and State soils. The soil is level or nearly level and is subject to overflow. External drainage is slow and internal drainage moderate to rapid. According to several tests the soil is very acid, low in calcium and magnesium, medium to low in potash and organic matter, and low to very low in phosphorus. The original trees were water-loving hardwoods, as willow, willow oak and perhaps a few other oaks, beech, birch, and ash. Many areas supported a thick growth of rhododendron and mountain-laurel.

Following is a profile description in a cleared area:

0 to 10 inches, light-brown to brown friable fine sandy loam, containing numerous finely divided mica flakes.
10 to 30 inches, yellowish-brown to light-brown loam to fine sandy loam; many finely divided mica flakes throughout.
30 inches +, mottled gray and brown fine sandy clay to loamy sand.

Variations are chiefly in the texture of the subsoil and the underlying material. The subsoil may consist of fine sandy loam, silt loam, or loamy fine sand, and the underlying material may vary from beds of gravel to stone-free silty clay loam. There are almost no indications of poor drainage either in the subsoil or underlying material.

Because of the level relief, ease of cultivation, and absence of drainage or erosion problems, this is one of the most desirable soils in the county for truck crops, especially string beans, and for corn, potatoes, hay, or pasture (pl. 3, *A*). Practically every area has been cleared and used at some time for crops. A large acreage is used for clean-cultivated crops and the rest mostly for hay. About one crop in four may be damaged by high water, and it is not unusual for areas to remain idle for a year after being severely damaged by flooding.

Congaree gravelly fine sandy loam (Cg) (slope, 0 to 3 percent).—Areas of this bottom-land soil generally occur along the larger and more swiftly flowing streams or along the overflow channels. Except in being gravelly, the soil is similar to Congaree fine sandy loam. There are enough stones up to 6 inches in diameter on the surface and in the soil to interfere with tillage operations. External drainage is slow to moderate and internal drainage generally rapid. The soil has about the same reaction as Congaree fine sandy loam, but the content of plant nutrients and organic matter is generally smaller. Areas are suited to corn, truck crops, and hay, but yields are not so high as on other Congaree soils because the stones make cultivation difficult and the soil is somewhat droughty.

Congaree silt loam (Co) (slope, 0 to 2 percent).—This soil differs from the fine sandy loam of the series in texture and in being more nearly level in most places. External drainage is slow and internal drainage moderate. Where not limed in recent years the soil is medium acid. Tests indicate that it is low in calcium and magnesium, very low in phosphorus, low to very low in potash, and high to medium in organic matter. The surface soil is generally brown friable smooth silt loam, and the subsoil yellowish-brown friable silt loam to friable silty clay loam. Areas occur along many of the larger streams.

The most notable variations are in the texture and consistence of the subsoil and in the height above stream level. The texture of the surface soil is dominantly silt loam, but that of the subsoil may be silt loam, silty clay loam, or even fine sandy loam to loamy fine sand, and when the subsoil is moist its consistence may range from sticky to only slightly cohesive. Some areas lie nearer stream level than others and are more often subject to overflow.

With very few exceptions all areas of Congaree silt loam have been cleared and are used for crops or pasture. The soil is used mostly for corn, but a small part is used for truck crops, hay, and pasture or is in idle land. It is one of the most suitable soils in the county for corn, truck crops, and hay, largely because of ease of tillage and capacity for producing high yields. It may be used very intensively in short rotations. About the only undesirable feature is flooding, and most farmers expect to lose, in part or entirely, one crop every 4 or 5 years.

Congaree-Toxaway silt loams (CT) (slope, 0 to 3 percent).—This level or nearly level complex occurs in first bottoms, usually near streams, and is subject to frequent overflow. It appears to have been originally Toxaway silt loam on which an 8- to 15-inch layer of Congaree silt loam material has been deposited by stream overflow since the advent of the white man's agriculture. External drainage is slow and internal drainage slow to moderate. The soil is strongly acid, is permeable to roots, air, and water, and in most places is capable of holding large quantities of water. The plant-nutrient supply and organic-matter content in the surface soil are more nearly like those of Congaree silt loam than of Toxaway silt loam.

The forest cover has been cleared, and the land is used for crop production. It is well suited to corn, small grains, and hay crops, but most of it is used for corn, to which it is probably best suited. It may be used for many of the tilled crops grown in very short rotations. Probably one crop in four will be lost or damaged by flooding. The productivity of the soil, however, is generally not impaired, since the material deposited on it by floods often has a more nearly balanced supply of plant nutrients than the original soil.

Halewood loam, hilly phase (Hml) (slope, 15 to 30 percent).—Weathered products of granite, gneiss, or schist are the parent material of this light-colored soil of the intermountain uplands. The soil occurs in the valleys and is associated with Hayesville and Clifton soils. External and internal drainage are moderate. According to an average of several soil tests in uncleared areas, the soil is medium

to strongly acid, very low in calcium, low in magnesium and phosphorus, fairly high in potash, and about medium in organic matter. The native vegetation consisted largely of white, post, black, and Spanish oaks and hickory, with some yellow-poplar, sourwood, and shortleaf and white pines. Chestnut, prior to the blight, was the dominant species, and many dead but sound trees are still standing. The undergrowth is principally azalea and mountain-laurel.

A profile from a forested area shows:

0 to 5 inches, light brown, grayish-brown, or yellowish-gray friable loam with many roots and a few pieces of gravel.
5 to 10 inches, yellowish-brown to brown friable loam containing a small quantity of quartz gravel and some finely divided mica flakes.
10 to 40 inches, yellowish-brown to brown firm but friable clay that breaks into irregular-shaped lumps when dry but is moderately friable when moist; contains a small quantity of gravel and some finely divided mica flakes.
40 to 50 inches, yellow and reddish-brown friable clay material grading into disintegrated light-colored granitic rock.

The most important variations are in the depth to bedrock and the quantity of stones on the surface and in the soil mass. The stones are not sufficiently abundant to interfere appreciably with tillage operations. The depth of the surface soil also varies to some extent. Areas totaling about 742 acres that have been cleared of the forest cover, tilled, and have lost up to 25 percent of the surface soil by accelerated erosion are included because of similar profile characteristics. These areas have not been impaired for crops, but care is necessary to prevent further damage to the soil by erosion.

Many areas of Halewood loam, hilly phase, could be cleared and used for small grains, hay crops, and pasture. If areas of the soil are to be used for intertilled crops, a good management practice would be a strip rotation in which only narrow contour strips of the field are plowed at any one time.

Halewood loam, eroded hilly phase (Hmh) (slope, 15 to 30 percent).—Although having the same relief as the hilly phase, this phase has lost 25 to 75 percent of the original surface soil by accelerated erosion. The remaining surface soil is shallow. The yellowish-brown plow layer contains some subsoil material and is somewhat heavier than the original surface soil. The total thickness of the surface soil and subsoil ranges from 18 to more than 40 inches but in most places averages about 32 inches. A few gullies too deep to be obliterated by tillage operations are crossable with farm equipment. External drainage is moderate to rapid and internal drainage moderate. Where the soil has not been recently limed or heavily fertilized, the soil reaction and content of plant nutrients do not differ greatly from those in forested areas of the hilly phase, but the content of organic matter is considerably less. The soil is associated with other members of the Halewood series.

In places there are some stones on the surface and in the soil, and locally there are color variations of the surface soil and subsoil. The soil is not sufficiently gravelly or stony to interfere greatly with tillage operations.

All areas of Halewood loam, eroded hilly phase, have been used for crops or pasture. There is considerable likelihood of further losses by erosion, and needed management for the soil includes adequate crop rotations, as discussed in the section on Use, Management, and

Productivity of the Soils. When necessary to grow row crops, the soil may be protected by using sod-forming or other close-growing vegetation 3 years in a 4-year rotation or by using a system of strip rotations (pls. 2, *B* and 4, *A*).

Halewood loam, rolling phase (Hmo) (slope, 7 to 15 percent).—This phase differs from the hilly phase chiefly in having milder slopes. It is therefore less subject to accelerated erosion, and runoff is more easily controlled. External and internal drainage are moderate. The reaction of the soil and its content of plant nutrients and organic matter do not differ greatly from the hilly phase, and the forest cover consists of about the same species of trees. The soil areas are relatively small and are associated with other members of the Halewood series.

Included are areas totaling about 316 acres that have been cleared and used for crops and pasture and as a result of accelerated erosion have lost up to 25 percent of the original surface soil. This loss has not impaired the soil to a very great extent, but the accompanying loss of organic matter has reduced its water-holding capacity.

When cleared, Halewood loam, rolling phase, is well suited to the growth of many crops. Care is necessary to control runoff and keep erosion at a minimum. The soil could be used in relatively short rotations for corn, tobacco, small grain, and hay crops. In some of the adjoining counties this phase is used for the production of high-quality vegetables; potatoes, cabbage, string beans, and spinach are probably among the better suited ones.

Halewood loam, eroded rolling phase (Hmg) (slope, 7 to 15 percent).—Like the other phases of Halewood loam, this intermountain upland soil is derived from weathered products of granite, gneiss, or schist. It differs, however, from the hilly phase in having rolling relief and from both the hilly and rolling phases in degree of erosion. Accelerated erosion has removed 25 to 75 percent of the original surface soil. Although the quantity of material removed varies greatly, the subsoil is within plow depth over most areas, and the plow layer is a mixture of surface soil and subsoil, lighter in color and finer in texture than the original surface soil. External drainage is moderate to rapid and internal drainage moderate. Except where this soil has been recently limed and heavily fertilized, the reaction and content of plant nutrients do not differ greatly from those of the hilly phase, but the content of organic matter is generally much smaller. The soil occurs in relatively small areas associated with other members of the Halewood series.

The most important variations are in the depth of the soil to bedrock, the quantity of stones on the surface and in the soil, and the color of the surface soil and subsoil. Generally there are not enough stones to interfere very much with tillage.

All areas of Halewood loam, eroded rolling phase, are cleared land used for crops and pasture. The soil is well suited to most crops of the county when grown under suitable rotations and proper fertilization. Management for controlling surface runoff is necessary to prevent further loss of soil material by erosion.

Halewood loam, steep phase (Hmz) (slope, 30 to 60 percent).—This phase is more sloping and somewhat less well developed than the hilly phase. Because of the steep slopes the profile generally is

not so deep to bedrock as Halewood soils on gentler slopes, and the cleared areas are more susceptible to accelerated erosion. The soil reaction, the content of mineral nutrients and organic matter, and the type of forest growth do not differ greatly from those of the hilly phase. The soil occurs in small to large areas associated with other members of the Halewood series.

A few variations occur in the quantity of stones on the surface and in the soil, in the depth to bedrock, and in the color of the surface soil and subsoil. Included because of similar profiles are areas totaling about 1,519 acres that have been cleared and used for crops or pasture and have lost up to 25 percent of the original surface soil. Except for the removal of organic matter, which has somewhat reduced the water-holding capacity of the soil, the effect of this loss of material has been slight.

If cleared, most areas of Halewood loam, steep phase, would be suitable for producing sod crops for hay or for grazing (pl. 4, *B*). Largely because of the steep slopes, the soil is not suited to intertilled crops; but when necessary to grow row crops, contour-strip rotations in which only narrow strips of any field are plowed at a time should be practiced. Good management of small fields would be to till them only 1 year in 4.

Halewood loam, eroded steep phase (Hmf) (slope, 30 to 60 percent).—Areas of this phase occur in association with other members of the Halewood series. This phase differs from the hilly phase in having stronger slopes and in having lost 25 to 75 percent of the original surface soil by accelerated erosion. The subsoil is nearly everywhere within plow depth. The plow layer consists of surface soil mixed by tillage with subsoil material and is lighter in color and heavier in consistence and texture than the original surface soil. A few gullies have formed, which are shallow enough to be crossed with farm implements but too deep to be obliterated by ordinary tillage. External drainage is rapid to very rapid and internal drainage moderate. Soil reaction is medium acid where the soil has not been recently limed. Unless the soil has been heavily fertilized, the content of plant nutrients is low.

Local variations are mainly those in the depth of remaining original surface soil, the content of gravel on the surface and in the soil, and the depth of the profile to bedrock. In a few places are color variations in the surface soil and subsoil.

Chiefly because of steep slopes and eroded condition, Halewood loam, eroded steep phase, is poorly suited to clean-cultivated crops, and is apparently best used for pasture. If it is necessary to use the soil for row crops, a good management practice would be a contour-strip rotation in which only a small part of the field is plowed at one time. Where this is not feasible, a suitable practice would be a tilled crop every 5 or 6 years, with the field in pasture or hay the rest of the time.

Halewood clay loam, severely eroded hilly phase (Hda) (slope, 15 to 30 percent).—The severely eroded condition and a heavier surface soil differentiate this phase from Halewood loam, hilly phase. Although the relief is the same as the hilly phase, this soil has lost more than 75 percent of the original surface and in places part of the subsoil through accelerated erosion. The quantity of material removed

by erosion varies widely, but in all areas the plow layer consists predominantly of subsoil material mixed by tillage with the little remaining surface soil. The soil to plow depth is clay loam and is lighter in color than the surface soil in uneroded areas. The many gullies are crossable with farm implements, but some are too deep to be obliterated by ordinary tillage methods. External drainage is rapid and internal drainage moderate. Even where lime and large quantities of fertilizer have been applied recently, the soil is medium acid and its content of plant nutrients and organic matter lower than in Halewood loam, hilly phase. This severely eroded hilly phase is associated with other members of the Halewood series.

Local variations exist in the color of the surface soil and subsoil, quantity of original surface soil that remains, quantity of stone on the surface and in the soil, and depth to bedrock. Although the stones vary in quantity from place to place, there are not usually enough to interfere with tillage.

Largely because of severely eroded condition and hilly relief, Halewood clay loam, severely eroded hilly phase, is unsuitable for tilled crops. Even where the erosion has been stabilized, the soil is only moderately well suited to grasses for pasture or hay. Close-growing vegetation, however, seems to be the best use of the soil.

Halewood clay loam, severely eroded rolling phase (Hds) (slope, 7 to 15 percent).—This soil is unlike Halewood loam, hilly phase, in being severely eroded, having a finer texture and lighter color in the surface soil, and occurring in areas of milder relief. Although it occupies the same type of relief as the rolling phase of Halewood loam, its surface soil is finer in texture and lighter in color. Accelerated erosion has removed more than 75 percent of the original surface soil and in places some of the subsoil. In most areas the soil to plow depth consists predominantly of a mixture of subsoil material and remaining original surface soil. The clay loam plow layer is lighter in color than the original surface soil. There are a few shallow gullies, which, although crossable with farm implements, are not obliterated by ordinary tillage. External drainage is moderate to rapid and internal drainage is moderate. Where not recently limed the soil is medium acid, and where not heavily fertilized it is lower in plant nutrients and organic matter than Halewood loam, hilly phase.

This severely eroded rolling phase is associated with other Halewood soils. It varies from place to place in quantity of original surface soil that remains, in color of surface soil and subsoil, in quantity of gravel on the surface and in the soil, and in depth to bedrock.

Mainly because of the severe erosion, Halewood clay loam, severely eroded rolling phase, is poorly suited to tilled crops. It may be used for grasses for hay or grazing, providing erosion is stabilized and good management practices are followed.

Halewood clay loam, severely eroded steep phase (Hdt) (slope, 30 to 60 percent).—This severely eroded soil differs from Halewood loam, hilly phase, in degree of erosion, texture and color of surface soil, relief, and depth to bedrock. Accelerated erosion has removed more than 75 percent of the surface soil and in many places also part of the subsoil. The mixture of the remnants of the surface soil with the subsoil by tillage has resulted in a clay loam plow layer lighter in color than the original surface soil. The soil in a few places is

severely gullied, and some of the gullies are too deep to be crossed with farm implements or obliterated by ordinary tillage operations. A few are more than 200 feet long and are very difficult to stabilize. External drainage is very rapid and internal drainage moderate. The soil is medium to strongly acid where it has not been limed recently, and where not fertilized its content of mineral plant nutrients and organic matter is much lower than in Halewood loam, hilly phase. The areas of this severely eroded steep phase are relatively small and are associated with areas of other Halewood soils.

The soil varies from place to place in quantity of original surface that remains and also in the color of the surface soil and subsoil, quantity of stone on the surface and in the soil, and depth to bedrock.

Halewood clay loam, severely eroded steep phase, is poorly suited to crops and pasture, and its best use is for trees, particularly pine.

Halewood stony loam, hilly phase (Hsl) (slope, 15 to 30 percent).—This soil differs from Halewood loam, hilly phase, chiefly in its stone content. It has the same origin, mode of occurrence, color and texture, but its profile is shallower to bedrock and there are enough stones ranging from small pieces of gravel to large boulders to interfere with tillage. Small bedrock outcrops occur. External drainage is moderate to rapid and internal drainage moderate. The soil is medium acid, and the content of mineral plant nutrients and organic matter is about the same as in Halewood loam, hilly phase. This hilly phase is forested with mixed hardwoods and pines and occurs in close association with other Halewood soils.

Local differences between areas of the soil are in the quantity and size of the stones on the surface and in the soil. There is some variation in the depth to bedrock and in the color of the surface soil and subsoil. Areas totaling about 54 acres that have been cleared and used for crops or pasture are included. They are slightly eroded and have lost up to 25 percent of the original surface soil.

Some areas of Halewood stony loam, hilly phase, would be suitable for pasture if cleared, but largely because of stony character and hilly relief the soil is not suited to intertilled crops and small grains.

Halewood stony loam, eroded hilly phase (Hsh) (slope, 15 to 30 percent).—Although having the same origin and mode of occurrence, this soil differs from Halewood loam, hilly phase, in being stony and moderately eroded. Enough stones, ranging from small pieces of gravel to large boulders, are on the surface and in the soil to interfere materially with tillage operations. Accelerated erosion has removed 25 to 75 percent of the original surface soil, and the plow layer consists of a mixture of surface soil and subsoil, which is heavier and slightly lighter colored than the original surface soil. A few gullies are present in places, and although crossable with farm implements, they are not generally obliterated by ordinary tillage. External drainage is moderate to rapid and internal drainage moderate. The soil is medium acid where it has not received recent lime applications, and, except where it has been heavily fertilized, it is lower in mineral plant nutrients and organic matter than Halewood loam, hilly phase.

Variations occur in the color of the surface soil and subsoil, quantity of stone present, and degree of erosion. The depth to bedrock ranges considerably. Severely eroded areas totaling about 54 acres, in which

A, Timothy and red clover on Congaree fine sandy loam in foreground; permanent pasture on Porters loam, eroded steep phase, in background.
B, Rye and winter oats on Masada loam, undulating phase.

A, Permanent pasture and long rotations being practiced on Halewood loam, eroded hilly phase.

B, Grazing land on Halewood loam, steep phase, in foreground; forest on the steeper stony Halewood soil in background.

C, Bluegrass and white clover pasture on Warne silt loam.

more than 75 percent of the surface soil and in places part of the subsoil have been removed by accelerated erosion, are included. In these areas the soil, to plow depth, is clay loam and mostly subsoil material, and gullies are present that interfere with tillage.

Except in severely eroded areas, Halewood stony loam, eroded hilly phase, is well suited to grasses and legumes for pasture. Hilly relief, stoniness, and eroded condition, however, exclude the soil from use for intertilled crops and small grains, and make it best suited to permanent pasture.

Halewood stony loam, steep phase (Hsz) (slope, 30 to 60 percent).—Areas of this phase are associated with the other Halewood soils. This soil differs from Halewood loam, hilly phase, in containing enough stones of various sizes to interfere to some extent with tillage and in having steeper slopes. Largely because of steeper slopes, runoff is more difficult to control and the soil is more susceptible to accelerated erosion when tilled. External drainage is rapid and internal drainage moderate. The soil is medium acid and the content of mineral plant nutrients and organic matter is about the same as in the hilly phase of Halewood loam. Part of the soil is in forest consisting principally of mixed oaks, with some dogwood, mountain-laurel, and rhododendron.

Locally there are slight variations in the color of the surface soil and subsoil, quantity and size of stones on the surface and in the soil, and depth of profile to bedrock. Areas totaling about 1,853 acres that have been cleared and farmed, and as a result have been slightly eroded, are included because of similar profile. Through farming these areas have lost enough organic matter to impair the water-holding capacity.

Chiefly because of steep slopes, stones, and ease of erosion, the cleared areas of Halewood stony loam, steep phase, are not suited to intertilled crops and only moderately well suited to grass and legumes for grazing. The uncleared areas should remain in forest, as their use for pasture when cleared is doubtful.

Halewood stony loam, eroded steep phase (Hsf) (slope, 30 to 60 percent).—This phase differs from Halewood loam, hilly phase, in being stony, steep, and eroded. It is associated with other Halewood soils. Enough stones of various sizes are on the surface and in the soil to interfere with tillage operations. Accelerated erosion has removed 25 to 75 percent of the original surface soil, leaving the subsoil within plow depth over much of each area. The plow layer consists of mixed surface soil and subsoil material and is somewhat lighter in color and heavier in consistence than the original surface soil. Some gullies that are crossable with farm implements but are too deep to be obliterated by tillage operations have formed. External drainage is rapid and internal drainage moderate. In areas that have not been limed or highly fertilized recently, the reaction and content of plant nutrients and organic matter are lower than for the hilly phase of Halewood loam.

Major variations in this eroded steep phase are in the quantity and size of the stones on the surface and in the soil, the depth of the profile to bedrock, and depth of original surface soil present. Locally there are some variations in the color of the surface soil and subsoil.

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Halewood stony loam, eroded steep phase, is only fair for the production of grasses and legumes for pasture. Largely because of the steep slopes, high content of stones, and eroded condition, it is not suited to growing clean-cultivated crops. Good pasture management, including proper fertilization and liming and grazing, is necessary if a good sod is to be maintained.

Halewood stony clay loam, severely eroded steep phase (Htt) (slope, 30 to 60 percent).—Areas of Halewood stony loam, steep phase, from which accelerated erosion has removed more than 75 percent of the original surface soil and in places some of the subsoil are included in this phase. The soil to plow depth consists largely of subsoil material mixed with remaining original surface soil by tillage, and the present surface soil is clay loam of considerably lighter color than the original. Many areas have gullies so deep that they are not obliterated by tillage operations and generally not crossable with farm implements. External drainage is very rapid and internal drainage moderate. The soil is medium acid, low in mineral plant nutrients, and almost lacking in organic matter. Areas of this severely eroded steep phase are associated with other Halewood soils in the intermountain areas.

There are some variations in the soil, mainly in the quantity of original surface soil that remains, quantity and size of stones present, and in extent of gullying.

Mainly because of steep slopes, stony condition, and severe erosion, Halewood stony clay loam, severely eroded steep phase, is very poorly suited to crops and pasture and best used for forest.

Hayesville loam, hilly phase (Hll) (slope, 15 to 30 percent).—This soil of the intermountain or valley areas is derived from weathered material of granite, gneiss, or schist and occurs in association with other Hayesville soils. External drainage is moderate and internal drainage slow to moderate. According to an average of several tests, the soil is strongly acid; very low in calcium, phosphorus, and potash; low in magnesium; medium in nitrogen; and high in organic matter. The vegetation consists of various oaks and hickory, with some sourwood, dogwood, maple, and yellow-poplar. In cutover areas there are many locust and shortleaf pine trees.

Following is a profile description:

0 to 6 inches, brown to yellowish-brown friable loam.
6 to 32 inches, brownish-red heavy brittle clay, which breaks into irregular-shaped lumps and crushes to a granular mass; sticky and slightly plastic when wet; some mica flakes in the upper part of the layer.
32 inches +, mixed red, brown, gray, and yellow disintegrated and partly decomposed mica schist rock.

Variations in thickness, ranging from 4 to 8 inches in the surface soil and from 20 to 30 in the subsoil, occur. The color of the surface soil and subsoil varies only slightly from place to place. The quantity of stone on the surface and in the soil varies considerably, but generally there is not enough stone to interfere materially with tillage. Areas that have been cleared and used for crops and pasture and as a result have been slightly eroded are included because of similar profile and small total acreage. The loss of organic matter by erosion, however, has been great enough to impair to some extent the water-holding capacity of the soil.

Some areas of Hayesville loam, hilly phase, may be cleared and used for small grains and hay crops. Under proper management, including adequate liming and fertilization, the soil is well suited to alfalfa and other leguminous crops. It is too steep and too susceptible to accelerated erosion, however, for planting to row crops.

Hayesville loam, rolling phase (Hlo) (slope, 7 to 15 percent).—This phase has the same general physical characteristics as the hilly phase but has milder slopes and is somewhat deeper to bedrock. External drainage is moderate and internal drainage moderate to slow. The soil reaction and content of mineral plant nutrients and organic matter have about the same range as for the hilly phase, and the forest growth is similar. Owing largely to its more gentle slopes, the soil when cleared is less easily eroded than the hilly phase. It is associated with other Hayesville soils.

The more noticeable variations in this phase are in the depth to bedrock, which ranges from 28 to 45 inches and averages about 35 inches, and in the quantity of stone on the surface and in the soil. The stone varies considerably but generally is not enough to interfere materially with tillage. Locally there are slight variations in the color of the surface soil and subsoil. Included because of similarity of profile are areas totaling about 204 acres that have been cleared and used for crops and pasture and as a result have lost up to 25 percent of the original surface soil by erosion. This loss of surface soil apparently has not adversely affected the soil, but the accompanying loss of organic matter has impaired the water-holding capacity.

Hayesville loam, rolling phase, is well suited to intertilled crops, and under good management, including short rotations, can be put to this use. Apparently most areas could be cleared and successfully used for crops. The soil is very well suited to alfalfa, wheat, barley, corn, and some truck crops.

Hayesville loam, steep phase (Hlz) (slope, 30 to 60 percent).—Strong slopes and a profile generally more shallow over bedrock distinguish this phase from the hilly phase of Hayesville loam. Areas are in the intermountain parts of the county in association with other phases of the Hayesville series. External drainage is rapid to very rapid and internal drainage slow to moderate. As indicated by several tests, the soil is strongly acid; very low in calcium, phosphate, and potash; low in magnesium; medium in nitrogen; and high in organic matter. Because of steeper slopes the soil when cleared is more susceptible to accelerated erosion than the hilly phase. The forest is hardwood, chiefly oak.

The main variations in this steep phase are in depth to bedrock, which ranges from 18 to 30 inches. Slight variations occur in the color of the surface soil and subsoil. Although the quantity of gravel varies considerably, there is not enough to interfere greatly with tillage. About 34 acres that have been cropped or pastured are included because of small extent and similar profile characteristics. These areas are now slightly eroded and have lost enough organic matter to reduce the water-holding capacity of the soil.

Chiefly because of steep slopes and ease of erosion when cleared, Hayesville loam, steep phase, is poorly suited to tilled crops. If necessary to grow tilled crops, a good practice for protecting the soil would be a contour-strip rotation. It is moderately well suited to pasture,

but pasture requires adequate lime and fertilizer and control of weeds and brushy growth.

Hayesville clay loam, eroded hilly phase (Hch) (slope, 15 to 30 percent).—Accelerated erosion has removed 25 to 75 percent of the original surface soil of this phase, and the subsoil is within plow depth. The color and texture of the surface soil differ from those of Hayesville loam, hilly phase. The reddish-brown clay loam plow layer is a mixture of remaining original surface soil and subsoil material. The depth of the soil to bedrock ranges from 20 to 32 inches. A few gullies have formed, which are generally shallow enough to permit crossing with tillage implements but too deep to be obliterated by ordinary tillage operations. External drainage is moderate to rapid and internal drainage moderate to slow. Where the soil has not been limed recently or heavy applications of fertilizer made, the reaction is about the same as for Hayesville loam, hilly phase, but the content of mineral plant nutrients and organic matter is lower. Areas of this eroded hilly phase are associated with other Hayesville soils.

Local variations are in the quantity of original surface soil remaining and in the quantity of gravel on the surface and in the soil. There is generally not enough gravel to interfere very much with tillage.

This eroded hilly phase of Hayesville clay loam is moderately well suited to legumes and grasses for pasture or hay. Largely because of its hilly relief and eroded condition, the soil is poorly suited to intertilled crops. If it is necessary to grow intertilled crops, a good practice of soil management would be contour-strip rotation, with only narrow strips of the cultivated area broken each year. Apparently it is better to use the soil for row crops not more than 1 year out of every 4 or 5.

Hayesville clay loam, severely eroded hilly phase (Hca) (slope, 15 to 30 percent).—This phase has lost by accelerated erosion more than 75 percent of the original surface soil and in places a part of the subsoil. It differs from Hayesville loam, hilly phase, in depth, color, and texture of the surface soil. Although the quantity of material removed by erosion varies widely, in all areas either tillage is largely in the subsoil material or the subsoil is within plow depth. The brownish-red clay loam plow layer is a mixture of original surface soil and subsoil material. In places there are many gullies that are generally crossable with farm implements but too deep to be removed by ordinary tillage. External drainage is rapid to very rapid and internal drainage slow to moderate. Where lime has not been applied recently, the soil is strongly acid, and, except in fertilized areas, has a low content of mineral plant nutrients. It contains only a small quantity of organic matter.

There is considerable range from place to place in the quantity of original surface soil that remains and in the quantity of stone on the surface and in the soil. Local variations exist in the color of the surface soil and subsoil. The extent of gullying and depth of the gullies vary considerably.

This severely eroded hilly phase of Hayesville clay loam is unsuited to intertilled crops, but even though severely eroded, it is considered fairly well suited to grasses and legumes for pasture where adequately fertilized, limed, and seeded. When the soil is put in permanent pas-

ture, care is necessary that a good sod be maintained for controlling erosion. It may be necessary to remove cattle during drought because of the danger of overgrazing. On the other hand, in extremely wet weather it seems best to keep livestock off the pasture, since trampling tends to puddle the soil and reduce its water-absorbing capacity. As the soil is very low in organic matter, additions of this material would help to improve the physical condition.

Hayesville clay loam, eroded rolling phase (Hcg) (slope, 7 to 15 percent).—This phase differs from Hayesville loam, hilly phase, in having more gentle slopes and from the hilly and rolling phases of Hayesville loam in texture and color of the surface soil and in depth to bedrock. The soil occurs in relatively small areas closely associated with other Hayesville soils. Accelerated erosion has removed 25 to 75 percent of the original surface soil. Although the quantity of soil material removed varies greatly, over most areas the reddish-brown clay loam plow layer consists of a mixture of original surface soil and subsoil material. External drainage is moderate to rapid and internal drainage moderate to slow. Except where recently limed the soil is strongly acid, and where not fertilized, its content of mineral plant nutrients and organic matter is low.

Variations occur in degree of erosion, color of surface soil and subsoil, and in depth to bedrock. Stone is on the surface and in the soil in some areas but usually does not interfere with tillage.

Although moderately eroded, Hayesville clay loam, eroded rolling phase, is well suited to clean-cultivated crops under such practices as suitable crop rotations, contour tillage, proper fertilization, and the return of organic matter to the soil (pl. 2, *C*). Alfalfa, red clover, wheat, barley, and lespedeza are grown successfully.

Hayesville clay loam, severely eroded rolling phase (Hcs) (slope, 7 to 15 percent).—Before accelerated erosion removed more than 75 percent of the original surface soil and in places some of the subsoil, areas where this phase occurs were occupied by Hayesville loam, rolling phase. The brownish-red clay loam surface soil nearly everywhere consists of subsoil material or subsoil material mixed by tillage with remaining original surface soil. The few shallow gullies are crossable with farm machinery, but many are not obliterated by tillage. External drainage is moderate to rapid and internal drainage slow to moderate. Like other eroded Hayesville soils, this phase is strongly acid in areas where it has not been limed recently and is low in mineral plant nutrients and organic matter where it has not been heavily fertilized.

The more important variations are in the depth to bedrock and in the degree of gullying. Minor variations are in the color of the surface soil and subsoil and in the quantity of stone on the surface and in the soil. There is usually not enough stone to interfere very much with tillage.

Although Hayesville clay loam, severely eroded rolling phase, has favorable surface relief for cultivation, it is poorly suited to tilled crops primarily because of severe erosion. The soil is fair for grasses and legumes, including alfalfa, and under good management would produce these plants in sufficient quantity for fair pasture or hay.

The pasture should not be overgrazed during drought and, since trampling tends to puddle the soil, cattle should be removed when the land is wet.

Hayesville clay loam, eroded steep phase (Hcf) (slope, 30 to 60 percent).—This phase differs from Hayesville loam, hilly phase, in being much steeper, moderately eroded, more shallow to bedrock, and lighter colored and finer textured in the surface soil. The quantity of surface soil lost by erosion ranges from 25 to 75 percent, and the subsoil nearly everywhere is within plow depth. The reddish-brown clay loam plow layer is a mixture of the original surface soil and the subsoil. The few gullies are crossable with farm implements but cannot be obliterated by tillage. External drainage is rapid to very rapid and internal drainage moderate to slow. Where lime has not been applied recently the soil is strongly acid, and where not heavily fertilized it is low in mineral plant nutrients. The content of organic matter is generally low, especially in unfertilized soil. This eroded steep phase occurs in large and small areas associated with other Hayesville soils.

Variations are in depth to bedrock, extent of sheet and gully erosion, and in quantity of stone on the surface and in the soil. The stone does not generally interfere materially with tillage.

Mainly because of steep slopes and eroded condition, Hayesville clay loam, eroded steep phase, is poorly suited to cultivated crops but under good management is fair for pasture.

Hayesville clay loam, severely eroded steep phase (Hct) (slope, 30 to 60 percent).—Accelerated erosion has removed more than 75 percent of the original surface soil and in many places some of the subsoil from this phase. The quantity of soil material lost by erosion varies considerably, but in average areas the plow layer, since it consists chiefly of subsoil material mixed with the remaining surface soil, is brownish-red clay loam. In some areas the soil is severely gullied, and some of the gullies are too deep to be crossed with farm implements or to be obliterated by ordinary tillage. A few of the gullies are 200 feet or more long and are very difficult to stabilize. External drainage on all areas is very rapid and internal drainage moderate to slow. The soil is strongly acid, low in content of mineral plant nutrients, and very low in organic matter. It occurs in relatively small areas closely associated with other Hayesville soils.

Local variations are in the severity of sheet erosion, extent of gullying, quantity of gravel on the surface and in the soil, and in depth of the soil to bedrock. Generally there is little gravel.

This severely eroded steep phase of Hayesville clay loam is rendered unsuitable for crops and pasture by its steep slope and severe erosion. Its best use is for trees, particularly pine.

Hiwassee clay loam, eroded rolling phase (Hwg) (slope, 2 to 15 percent).—Small areas of this soil occur in the intermountain parts of the county on high stream terraces in association with Masada, Hayesville, and Halewood soils. The soil has formed on sloping or rolling relief from old alluvium composed of material originating from crystalline rocks. Accelerated erosion has removed 25 to 75 percent of the original surface soil; as a result, the soil to plow depth

is a mixture of remaining surface soil and subsoil material and is reddish-brown clay loam. The subsoil is reddish-brown heavy clay. External drainage is moderate and internal drainage moderate to slow. As shown by tests of several samples taken from cultivated fields, the soil where not limed and fertilized is medium acid, medium to low in calcium and magnesium, low to very low in phosphorus, medium in potash and nitrogen, and fairly high in organic matter. It formerly supported a growth of large hardwood trees and an undergrowth of dogwood, sourwood, rhododendron, mountain-laurel, huckleberry, and buckberry.

In a cultivated field the following profile was observed:

0 to 6 inches, dark-brown or reddish-brown heavy slightly sticky to moderately plastic clay loam with some organic matter.
6 to 40 inches, brownish-red or red heavy brittle clay; sticky and moderately compact and plastic when wet; crushes to a friable mass when dry.
40 inches +, light brownish-red friable clay loam, sticky and slightly plastic when wet; underlain by gravel.

The profile is uniform in characteristics, the greatest variation being in depth to the underlying gravel or bedrock. The degree of erosion varies somewhat. Slightly eroded undulating areas totaling about 35 acres, the slopes of which are 3 to 7 percent, are included because of small extent. These areas have lost less than 25 percent of the original surface soil by erosion. About 45 acres of sloping relief (7 to 15 percent) that have lost less than 25 percent of the original surface soil by erosion are also included.

Hiwassee clay loam, eroded rolling phase, is a fertile soil especially suitable for corn, wheat, barley, alfalfa, and clover. It is only fair for most truck crops because of the difficulty of cultivating it under a wide range of moisture conditions. Locally, the soil is known as push land because it sticks to tillage implements. The tillage range is narrow—the soil will puddle if too wet and break into large clods if too dry. This difficulty in tillage and the tendency toward accelerated erosion under intensive management are the chief undesirable properties of the soil.

Hiwassee clay loam, eroded hilly phase (Hwh) (slope, 15 to 30 percent).—Although having the same origin, mode of occurrence, and generally well-developed profile as the eroded rolling phase, this phase differs mainly in its surface relief. External drainage is moderate to rapid and internal drainage moderate to slow. Soil reaction and content of plant nutrients and organic matter are about the same as for the eroded rolling phase.

Like the eroded rolling phase, this soil is very uniform in characteristics, the only noticeable variations being in degree of erosion and depth to gravel or bedrock. The thickness of the subsoil varies somewhat. Slightly eroded areas, totaling about 37 acres, that have lost less than 25 percent of the original surface soil and areas, totaling about 30 acres, that have enough water-worn pieces of gravel on the surface and in the soil mass to interfere with tillage are included because of small extent.

Hiwassee clay loam, eroded hilly phase, is practically all under cultivation or in sod crops. Chiefly because of its relief and eroded condition, the soil can be used best for sod crops or other close-growing

vegetation. Like the eroded rolling phase it is known locally as push land. It has a very narrow moisture range for tillage operations; if tilled when too moist it will puddle and become hard, or, when too dry, will break into large very firm clods. The addition of organic matter will partly correct the tendency of the soil to puddle and clod.

Made land (Md) (slope, 0 to 3 percent).—This land type includes areas of made land used for buildings, storage, or playgrounds. One large area in Canton, used as a yard for storing pulpwood, is bottom land that has been covered with cinders from a fiber plant.

Masada loam, undulating phase (Mlu) (slope, 3 to 7 percent).—Closely associated with the Hiwassee soils and lying near Hayesville and Halewood soils, this undulating and gently sloping soil occurs on high terraces along the larger streams of the county. It is derived from old alluvium consisting of material that originated in crystalline rocks. External and internal drainage are slow to moderate. The soil is medium to strongly acid, low to medium in calcium and magnesium, very low to low in phosphorus, medium to fairly high in potash, and medium in nitrogen and organic matter. Originally, this phase supported a growth of hardwood trees, but nearly all areas have been cleared for crops or pasture.

The following profile was taken from one of the few forested areas:

0 to 6 inches, light-brown loam containing some organic matter.
6 to 30 inches, light reddish-brown heavy clay.
30 inches +, reddish-brown friable clay streaked with yellow; underlain by gravel.

Like the Hiwassee soils, this undulating phase is very uniform in characteristics, the most noticeable variation being in the thickness of the surface soil. Areas totaling about 348 acres that are slightly eroded, having lost less than 25 percent of the original surface soil, and about 26 acres that are gravelly enough to interfere materially with tillage are included because of similar profile.

This undulating phase is nearly all used for most of the common crops and pasture, to which it is well suited. Relatively short rotations can be used, and the soil is especially suitable for corn, alfalfa, clover, small grains, and truck crops (pl. 3, *B*). Leguminous crops turned under should increase the organic-matter content and aid in maintaining a good supply of moisture.

Masada loam, rolling phase (Mlo) (slope, 7 to 15 percent).—This soil differs from the undulating phase chiefly in occupying areas of stronger relief. External drainage is moderate and internal drainage moderate to slow. The soil is closely associated with other Masada soils and with Hiwassee soils and is near Hayesville and Halewood soils.

Except for slight differences in depth to gravel this phase is relatively uniform throughout. Included because of similar physical characteristics are about 231 acres that have been used for crops and pasture and have lost less than 25 percent of the original surface soil. Other included areas, totaling about 31 acres and not appreciably eroded, have enough gravel on the surface and in the soil to interfere somewhat with tillage.

Masada loam, rolling phase, is well suited to most crops grown in the county, especially corn, small grain, alfalfa, clover, and grass. It

is fairly well suited to truck crops, as spinach, beans, and potatoes, and it produces high-quality burley tobacco. Needed management includes a good crop rotation that will supply the soil with organic matter. Runoff is reduced when crop rows are run across the slope and a legume is turned under once in 3 years.

Masada clay loam, eroded rolling phase (Mcg) (slope, 7 to 15 percent).—This phase differs from the rolling phase of the loam in texture and color of the surface soil. It is closely associated with other Masada soils and with Hiwassee soils. Over most areas accelerated erosion has removed nearly half to somewhat more than three-fourths of the original surface soil. The subsoil is within plow depth, and the plow layer is light reddish-brown clay loam. In some areas there are some gullies, most of which are too deep to be obliterated by ordinary tillage but may be crossed with farm equipment. External drainage is moderate and internal drainage moderate to slow. There are a few areas that are sufficiently gravelly to interfere with tillage and these are designated on the soil map by symbol.

Although materially damaged by erosion, this eroded rolling phase is suitable for intensive cropping under good management. Row crops should not be grown for 2 years in succession, and a winter cover crop is necessary except where the soil is broken in fall and left rough until spring. The soil is very well suited to small grains, alfalfa, and clover and well suited to grass, corn, vegetables, and burley tobacco. A good management practice consists of turning under a winter cover crop every other year for row crops. Crop rows placed along the contour help to retard surface runoff, but this practice alone will not control erosion.

Masada clay loam, eroded hilly phase (Mch) (slope, 15 to 30 percent).—This phase comprises former areas of Masada loam, hilly phase, that have lost under cultivation a large part of the original surface soil by erosion. Over most areas between one-half and three-fourths of the original surface has been removed, and in many places the reddish-brown clay loam plow layer consists largely of subsoil material. In some areas there are many shallow gullies which, although crossable with tilling implements, cannot be obliterated entirely by ordinary tillage. External drainage is moderate to rapid and internal drainage moderate to slow.

Small areas are included that have the same slopes as this phase but differ in character of the surface soil. Some of these areas have lost very little surface soil by accelerated erosion; others have lost a large part or all. A few small eroded hilly areas that are gravelly enough to interfere with tillage are also included.

Less than half of Masada clay loam, eroded hilly phase, is used for crops, since by necessity a large part has been seeded to pasture. The soil is easily eroded, and the control of surface runoff is difficult. Apparently the best use is for pasture, or possibly hay on the less steep slopes. Where tillage is required, it is best to use a strip-crop rotation, so that not more than a fourth of the field is in a row crop during any one season. Under this management the soil can be used continuously with little probability of much loss of soil material by erosion. Strips of legume sod crops when turned under should prove beneficial for the row crop in the rotation. Applications of lime and phosphate

are essential for good pasture or hay, and a complete fertilizer is needed for corn or other row crops.

Porters loam, steep phase (Plz) (slope, 30 to 60 percent).—This fertile mountainous soil is derived from weathered material of granite, gneiss, or schist. It is associated with Ashe, Halewood, and Hayesville soils. External drainage is rapid and internal drainage moderate. According to averages of soil tests, the soil is medium acid, low to medium in calcium, medium in magnesium and nitrogen, low to very low in phosphorus, fairly high to medium in potash, and high in organic matter. Natural vegetation consists of red, black, and chestnut oaks; maple; sourwood; and hickory, with an undergrowth of azalea, rhododendron, mountain-laurel, fern, galax, and trailing-arbutus. Chestnut trees once dominated the forest but were killed by blight about 1926.

Following is a profile description:

0 to 10 inches, brown to dark-brown friable loam with a large quantity of organic matter and having a fine granular structure.
10 to 25 inches, brown to yellowish-brown friable heavy loam to light clay loam with a few pieces of schist rock.
25 inches +, gray and brown decayed schist rock fragments with some soil material.

Variations are chiefly in depth to bedrock and in quantity of rock fragments on the surface and in the soil. These fragments are not usually present in sufficient quantities to interfere with tillage. In some places the soil is slightly micaceous. A good color profile has developed locally, but there is little or no difference between the texture of the surface soil and that of the subsoil. Included are cleared areas, totaling about 3,018 acres, that have been used for pasture or crops and have lost through accelerated erosion less than 25 percent of the original surface soil.

Most of the saw timber has been removed from Porters loam, steep phase. If cleared, many areas could be used for pasture, for which the soil is well suited. The slopes are too steep for satisfactorily growing of row crops, small grains, or in most places hay.

Porters loam, eroded steep phase (Plf) (slope, 30 to 60 percent).—Accelerated erosion has removed 25 to 75 percent of the original surface soil of this phase. The brown friable loam plow layer consists of remaining original surface soil mixed with subsoil material. A few shallow gullies have formed in places. The soil is strongly acid and the supply of organic matter is moderate. The content of mineral plant nutrients is low, except where the soil has been recently fertilized. This phase is associated with other members of the Porters series in the mountainous parts of the county and differs from the steep phase in the degree of erosion and in depth to bedrock. A common variation in the soil is in the degree of erosion and in the depth to bedrock. A few small areas that are more micaceous than usual for the soil are included.

This eroded steep phase of Porters loam has been cleared and used for tilled crops, to which it is poorly suited largely because of the steep slopes. Like the steep phase, it is well suited to grasses for grazing. Liming, fertilization, and the control of weeds and grazing are necessary management requirements to provide enough sod for livestock and to protect the soil against erosion.

Porters loam, severely eroded steep phase (Plt) (slope, 30 to 60 percent).—More than 75 percent of the original surface soil of this phase and in places part of the subsoil have been lost through accelerated erosion. The plow layer, composed chiefly of subsoil material mixed with remaining original surface soil, is somewhat lighter in color and slightly heavier in consistence than Porters loam, steep phase. The soil is severely gullied and the gullies are crossable with some farm implements but are not obliterated by tillage operations. This phase has rapid to very rapid external drainage and moderate internal drainage. Where not limed and fertilized recently, the soil is strongly acid, and its content of mineral plant nutrients and organic matter is low. In a few places stones are on the surface and mixed through the soil, but not in sufficient quantity to interfere with tillage.

Largely because of severe sheet erosion and gullies, shallow depth to bedrock, and steep slopes, this phase is unsuitable for crops and pasture and is best used for forest.

Porters loam, very steep phase (Plv) (slope, 60 percent +).—Because this soil is on stronger relief than the steep phase, it is more susceptible to erosion when cleared. Areas occur in the more mountainous parts of the country in association with other Porters soils and Ashe soils. External drainage is very rapid and internal drainage moderate. The soil is strongly acid and has a relatively high content of organic matter and a medium to low content of mineral plant nutrients. The forest growth is largely mixed oaks interspersed with a few other hardwoods, as hickory, yellow-poplar, and buckeye. At one time chestnut was the dominant tree, but the blight in 1926 killed practically all the trees. In places there is a heavy undergrowth of mountain-laurel and rhododendron.

There is considerable range in the depth of this phase to bedrock, but the depth nearly everywhere is less than 20 inches. Included because of small total extent are about 104 acres that have been cleared, used for crops and pasture, and, as a result, have lost up to about 25 percent of the original surface soil. An additional 197 acres have been used for crops or pasture and have lost between 25 and 75 percent of the original surface soil. A total of about 25 acres of severely eroded land that has lost more than 75 percent of the original surface and in places some of the subsoil is also included.

Porters loam, very steep phase, is poorly suited to crops or pasture and is best suited physically to forest.

Porters stony loam, steep phase (Psz) (slope, 30 to 60 percent).—Associated with Porters loam, steep phase, are many areas of this steep phase that have enough stone on the surface and mixed with the soil to make them unsuitable for tillage. The loose stones vary in size from small pieces of gravel to large boulders. There are also some outcrops of bedrock. External drainage is rapid and internal drainage moderate. The soil reaction, organic-matter content, and supply of mineral plant nutrients are about the same as for Porters loam, steep phase. The original forest growth probably was not so dense, and there were more white pine, mountain-laurel, and rhododendron.

This steep phase varies considerably from place to place in degree of profile development and in depth to bedrock. Locally there is

only a color profile, with little or no difference in the texture of the soil from the surface to the underlying rock. In most places the depth to bedrock is less than 22 inches.

Largely because of stones and steep slopes, Porters stony loam, steep phase, is not suited to the growth of intertilled crops, small grains, or hay. Although some of the less stony areas can be used for pasture, the best use for the soil as a whole is for forest.

Porters stony loam, eroded steep phase (Psf) (slope, 30 to 60 percent).—This soil differs from Porters loam, steep phase, in that it is stony and moderately eroded. Rock fragments are numerous enough on the surface and in the soil to interfere materially with tillage, and accelerated erosion has removed between 25 and 75 percent of the original soil. The present brown surface soil consists largely of remnants of the original surface soil mixed by tillage with subsoil material. In places a few gullies have formed, which cannot be completely filled by ordinary tillage methods. External drainage is rapid and internal drainage moderate to somewhat rapid. Except where recently limed and fertilized, the soil is strongly acid and low in mineral plant nutrients and organic matter. Areas are associated with other Porters soils.

This phase varies much from place to place in quantity of stones and in degree of erosion. All areas, however, have lost much soil. A total of about 76 acres of severely eroded soil that has lost more than 75 percent of the original surface soil and in spots some of the subsoil is included because of small extent.

Porters stony loam, eroded steep phase, is wholly unsuited to the production of crops or pasture and is best used for forest.

Porters stony loam, hilly phase (Psl) (slope, 15 to 30 percent).—This phase is in the mountainous part of the county in association with other Porters soils. It differs from Porters loam, steep phase, in having gentler slopes, in being stony, and in a few places in being slightly more distinct in profile development. The quantity of stones on the surface and in the soil varies widely. In some areas the stones are only numerous enough to interfere with tillage, whereas in others they are so numerous that there is very little soil. Over most of the soil external drainage is moderate to rapid; internal drainage is everywhere moderate. The soil is strongly acid, relatively high in organic matter, and moderate to low in mineral plant nutrients. The forest consists mostly of mixed hardwoods, including principally oak, hickory, cucumbertree (magnolia), and buckeye. In the more stony areas there is a dense undergrowth of mountain-laurel and rhododendron.

Largely because of the stones and strong slopes, this phase is unsuitable for intertilled crops or small grains but is suited to grasses and legumes for pasture. Where the soil is used for row crops nearly all tillage operations are carried out by hand, since the use of horse-drawn equipment is almost impossible. About 197 acres of this soil have become slightly eroded through use for crops or pasture. Some areas are probably better suited to forest than to pasture.

Porters stony loam, eroded hilly phase (Psh) (slope 15 to 30 percent).—The clearing and use of this soil for crops or pasture have caused moderate erosion. Where the soil is cultivated, the plow layer

consists of subsoil material mixed with original surface soil and has a somewhat lighter color and slightly heavier consistence than the original surface soil. There are only a few gullies. The stones on the surface and in the soil tend to reduce the quantity of soil lost by erosion. External drainage is moderate to rapid and internal drainage moderate. Unless recently limed, the soil is strongly acid, and where not fertilized, low in mineral plant nutrients. It has a moderate supply of organic matter.

Like the other stony soils of the county, this phase shows considerable range in the color and texture of the surface soil, in the content of stone, and in the degree of profile development.

Chiefly because of its stony character and hilly slopes, Porters stony loam, eroded hilly phase, is poorly suited to the growth of clean-cultivated crops and is only fair for small grain and hay. Stones interfere with tillage by ordinary implements, and tilling is done largely by hand tools. In some places enough stones have been removed to improve tillage conditions. The soil is moderately well suited to pasture, and its best use is for permanent sod.

Porters stony loam, very steep phase (Psv) (slope, 60 percent+).—Because of unfavorable features this phase is very poorly suited to crops or pasture and is best suited to forest. Cleared areas should be reforested. The stones on and in the soil would interfere materially with tillage if it were cleared for cultivation. The forest consists largely of mixed oaks, with some hickory, pine, spruce, and hemlock. In places is a dense undergrowth of mountain-laurel and rhododendron. This soil occurs in association with other Porters soils. External drainage is rapid to very rapid and internal drainage moderate.

Throughout its extent there is little or no uniformity in this very steep phase, and wide differences exist in the depth to bedrock and in the quantity and size of stones present. About 190 acres are included that have been cleared and used for crops or pasture. Such areas have lost as much as 75 percent of the original surface soil and in places show some tendency toward gullying.

Ramsey loam, steep phase (Rlz) (slope, 30 to 60 percent).—Areas of this phase are on mountains in the more rugged parts of the county. Throughout the extent of this phase the profile is shallow to bedrock, and the subsoil is poorly developed. The parent rock, which is high in silica, consists of shale, slate, sandstone, and quartzite. The soil has a pale-brown loam surface and a strong-brown or yellowish-brown loam to light clay loam subsoil. External and internal drainage are moderate to rapid. Averages of a number of soil tests in undisturbed soil in wooded areas indicate that the soil is strongly acid; very low to medium low in calcium, magnesium, and potash; fairly high in nitrogen; and very low to low in phosphorus. The organic-matter content in the first 4 inches of the surface soil generally is rather high. The forest consists chiefly of white and pitch pine; locust; hemlock; maple; yellow-poplar; black and yellow birch; sourwood; chestnut, white, and scarlet oaks; southern balsam; and spruce.

Following is a profile taken in a forested area:

0 to 3 inches, gray friable loam, containing much organic matter and many roots.

3 to 18 inches, yellow or brownish-yellow friable loam containing some small fragments of sandstone or shale; slightly sticky when wet.
18 inches +, shale or sandstone fragments intermixed with soil material.

In some places there is little difference between surface soil and subsoil, whereas in others the subsoil is notably heavier and more yellowish brown. The greatest depth of the profile to bedrock is about 20 inches, but it averages about 15. Small rock fragments are on the surface and in the soil but would not interfere with cultivation should the soil ever be cleared. A few small areas that have been used at some time for crop production and have lost up to 25 percent of the original surface soil by erosion are included.

Ramsey loam, steep phase, is very poorly suited to crops that require tillage, poorly suited to pasture, and best suited to forest.

Ramsey loam, eroded steep phase (Rlf) (slope, 30 to 60 percent).—Since cultivation this soil has lost between 25 and 75 percent of the original surface soil by accelerated erosion. Throughout its extent it varies considerably in profile development and degree of erosion. In many places the subsoil is within plow depth. There are a few shallow gullies, which are crossable with farm machinery but not completely filled by ordinary tillage operations. External drainage is rapid to very rapid and internal drainage moderate to rapid. Unless recently limed and fertilized, the soil is strongly acid and low in content of mineral plant nutrients.

Areas of this phase are in the northern part of the county. The soil is very poorly suited to crops, poorly suited to pasture, and best suited to forest. It is very susceptible to erosion, as is evidenced by its present eroded condition, and further loss of soil material is difficult to prevent.

Ramsey loam, severely eroded steep phase (Rlt) (slope, 30 to 60 percent).—Accelerated erosion has removed practically all the original surface soil and in places part of the subsoil of this phase. Some areas are badly gullied, and in places so much of the soil has been washed away that only the parent material remains. Many shale fragments are on the surface and mixed through the soil. External drainage is rapid to very rapid and internal drainage moderate to rapid. The soil is strongly acid and is very low in organic matter and mineral plant nutrients.

Because of unfavorable features this phase is unsuited to crops and pasture. Its best use is for forest, but in many places the soil will have to be prepared and care of the young trees will be necessary. Suitable management for growing trees includes mulching, proper diversion of water, and protection from livestock.

Ramsey loam, hilly phase (Rll) (slope, 15 to 30 percent).—This phase differs from the steep phase in having gentler slopes and a slightly deeper profile to bedrock. Because of its relief, it would be less subject to accelerated erosion if cleared. The soil is strongly acid, moderately high in organic matter, and rather low in mineral plant nutrients. External drainage is moderate and internal drainage is rapid. This phase supports a fair to good cover of mixed hardwood trees, interspersed with some pine, spruce, and hemlock, and in places there is an undergrowth of mountain-laurel and rhododendron.

The profile varies in depth to bedrock, the extreme range being 8 to 24 inches. Some shale fragments are on the surface and in the

soil, but there are not enough to interfere with tillage should the soil be cleared for cultivation.

Largely because of the hilly surface, shallow depth to bedrock, and low natural fertility, this hilly phase is very poor for crops and poor for pasture. It is best suited to forest, for which all of it is used at the present time.

Ramsey loam, eroded hilly phase (Rlh) (slope, 15 to 30 percent).—As a result of cultivation this soil has lost 25 to 75 percent of the original surface soil. Consequently the subsoil or, in places, the parent material is within plow depth. Numerous small shale or slate fragments are on the surface and in the surface soil in many places. Shallow gullies have formed in some areas and are crossable with farm equipment but cannot be entirely obliterated by ordinary tillage operations. Where not recently limed and fertilized, the soil is strongly acid and low in content of mineral plant nutrients. External and internal drainage are moderate to rapid.

Included with this eroded hilly phase as mapped are several small areas totaling about 229 acres, from which practically all the surface soil and subsoil have been removed by accelerated erosion, and mainly parent material remains.

Owing to unfavorable characteristics, Ramsey loam, eroded hilly phase, is very poor for crops, only fair for pasture, and best suited to forest.

Ramsey loam, very steep phase (Rlv) (slope, 60 percent +).—Except for its steeper slopes this soil is similar to the steep phase. Nearly everywhere the depth of the soil to bedrock is less than 20 inches, and in most places, 10 or 12. External drainage is very rapid and internal drainage moderate to rapid. The soil is strongly to very strongly acid and has a low content of mineral plant nutrients. At the higher altitudes, however, the content of organic matter is relatively great. The forest cover consists largely of mixed hardwood trees interspersed with white pine and hemlock and, at the higher elevations, spruce. In many places there is a dense undergrowth of mountain-laurel and rhododendron.

This phase is all in forest. Largely because of shallow depth to bedrock, extremely steep slopes, and ease of erosion if cleared and cultivated, the soil is best used for forest.

Ramsey stony loam, steep phase (Rtz) (slope, 30 to 60 percent).—This phase consists of areas of Ramsey loam, steep phase, which have sufficient stones on the surface and in the soil to interfere materially with tillage operations should the land be cleared of forest. The stones range in size from small shale particles to large boulders. There are a few outcrops of bedrock, the depth to bedrock ranging from a few inches to about 15. External drainage is rapid and internal drainage moderate to rapid. The soil is strongly acid and has a comparatively low content of mineral plant nutrients. Its content of organic matter, however, is relatively high, especially on slopes facing north.

This steep phase is all in forest, mainly of mixed hardwoods interspersed with conifers, which increase in number at the higher elevations. On southern exposures there is a fair to moderately dense undergrowth of mountain-laurel and rhododendron. Unfavorable char-

acteristics make this phase very poor for crops or pasture. It is best used for forest.

Ramsey stony loam, eroded steep phase (Rtf) (slope, 30 to 60 percent).—Areas of this phase have been cleared and cultivated and have lost by accelerated erosion 25 to 75 percent of the original surface soil and in many places some of the subsoil. Enough stones are on the surface and in the soil to interfere greatly with cultivation, and tillage is done with hand tools. External drainage is rapid to very rapid and internal drainage moderate to rapid. The soil is strongly acid, and in nearly all areas its content of mineral plant nutrients is very low.

Variations in color and texture of the surface soil and subsoil are common. The quantity of original surface soil remaining and the degree of stoniness vary considerably from place to place. Severely eroded areas totaling about 216 acres that have little or no remaining surface soil and subsoil and have the parent material exposed in most places are included.

Ramsey stony loam, eroded steep phase, is very poorly suited to crops or pasture, and its best use is for forest. White and shortleaf pines are among the more suitable trees. Where planting is to be done, much care, as mulching the soil, properly diverting water from it, and protecting the trees from livestock, may be necessary to establish a desirable stand.

Ramsey stony loam, hilly phase (Rtl) (slope, 15 to 30 percent).—Although similar to Ramsey loam, steep phase, in most respects, this phase differs mainly in having gentler slopes and in being stony. The stones range from small rock fragments to large boulders and there are enough on the surface and in the soil to hinder tillage somewhat. There are some outcrops of bedrock. External and internal drainage are moderate to rapid. According to tests, the soil is strongly acid and rather low in mineral plant nutrients. The surface soil, especially on slopes facing north, has a moderate to moderately high content of organic matter. Most of the phase is in forest consisting mainly of oak with a few white pine, hemlock, and spruce. This hilly phase is associated with other Ramsey soils. Areas totaling about 116 acres that have become slightly eroded since cleared and cultivated or used for pasture are included because of small extent.

Largely because of hilly surface relief, stony character, shallow profile over bedrock, and low natural fertility, Ramsey stony loam, hilly phase, is poorly suited to crops and pasture. It is best suited to forest, and even the cleared areas would be best used if planted to trees.

Ramsey stony loam, eroded hilly phase (Rth) (slope, 15 to 30 percent).—This soil has been cleared and cultivated and as a result of accelerated erosion has lost 25 to 75 percent of the original surface soil. The remaining surface soil is generally very thin and in many places the subsoil is within plow depth. The soil contains enough stones to interfere somewhat with cultivation, and most tillage operations are performed with hand implements. External and internal drainage are moderate to rapid. Except where recently limed and fertilized, the soil is strongly acid and is relatively low in mineral

plant nutrients. In most places it is poorly supplied with organic matter.

The soil is very poorly suited to crops and to pasture largely because of its shallow depth to bedrock, stony condition, and hilly surface relief. Although the stones tend to slow surface runoff, the loss of soil material by erosion in cultivated areas is serious. Most of the soil is best suited to forest, although a few areas can be used for pasture with the prospect of fair grazing and moderate runoff.

Ramsey stony loam, very steep phase (Rtv) (slope, 60 percent+).—Except for the numerous stones and generally more shallow depth to bedrock, the profile of this phase is similar to that of Ramsey loam, steep phase. Many rock fragments from the size of pebbles to large boulders are on the surface and to some extent in the soil. External drainage is very rapid and internal drainage moderate to rapid. The soil is strongly acid and relatively low in mineral plant nutrients but has a moderately high content of organic matter in the surface soil. Nearly all the phase is in forest consisting principally of mixed hardwoods at the lower elevations and of hardwoods, white pine, hemlock, and spruce at the higher elevations. Areas of the soil are associated with other Ramsey soils.

There is considerable variation throughout the extent of this very steep phase in the quantity of stone present. The depth of the soil to bedrock also varies considerably, ranging from less than 6 inches to about 14. Because of similar profile, about 220 cleared acres are included that under cultivation or pasture have lost from very little to nearly all of the soil material by accelerated erosion.

Ramsey stony loam, very steep phase, is very poorly suited to crops and pasture. It can be used to best advantage by keeping it in forest or planting the cleared areas in trees, as pine.

Rough gullied land (Halewood and Hayesville soil materials) (RgH) (slope, 7 to 30 percent).—Areas of Halewood and Hayesville soils that have become so severely gullied as to be practically useless for crops or pasture are included in this land type. Small patches of soil are in places, but nearly everywhere the soil has been so mutilated or so nearly destroyed by accelerated erosion that rebuilding it is hardly possible except by such slow processes as reforestation. External drainage is very rapid and internal drainage slow.

This rough gullied land is nearly all lying idle or slowly reverting to forest, but a few areas are in pasture. Apparently the best use is forest, and planting to white or shortleaf pines or other suitable trees is necessary where satisfactory natural reseeding is not possible. Mulching or other protection for the soil is required for obtaining a desirable stand of the trees. Lespedeza can be grown for temporary cover until other vegetation is established.

State loam, undulating phase (Slu) (slope, 3 to 7 percent).—This soil occurs on smooth alluvial terraces along the larger streams and is not subject to overflow. It is derived from moderately old alluvium consisting of material that originated from crystalline rocks. Areas are associated with Hiwassee, Masada, and Altavista soils on stream terraces, Congaree soils on first bottoms, and Hayesville and Halewood on uplands. External drainage is slow to moderate and inter-

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nal drainage moderate. According to tests made of samples taken from cultivated areas that had been moderately limed or fertilized, the soil is generally medium in reaction, medium in content of nitrogen and organic matter, medium to low in potash, and low in phosphorus. Originally the forest was probably hardwood, with an understory of mountain-laurel and rhododendron.

A profile description is as follows:

0 to 8 inches, light-brown to brown friable loam; slightly sticky when wet.
8 to 18 inches, yellowish-brown friable clay loam containing some mica flakes and breaking into irregularly shaped lumps ½ to 1 inch in diameter, which are easily crushed into a fine granular mass; slightly sticky when moist.
18 to 37 inches, yellowish-brown friable clay loam, streaked with gray and rust brown; contains some small mica flakes.
37 inches +, alternate beds of sand and gravel.

Little variation occurs in profile characteristics. The color and texture vary slightly from place to place, and a few pieces of rounded gravel are on the surface and in the soil here and there. Included because of similar soil profile are areas totaling about 424 acres that through poor management have lost up to 25 percent of the original surface soil by erosion but are not damaged to any great degree for crops or pasture. This loss of material, however, indicates that the soil, where not properly managed, is capable of being eroded.

State loam, undulating phase, is a desirable soil for truck, corn, small-grain, hay, tobacco, and other crops grown in the area. The soil responds very well to good management and is suitable for intensive cropping. It is fertile and can be made highly productive. Although it is especially well suited to the growing of row crops alone, a good practice of management would be the use of a crop rotation in which a leguminous crop is turned under at least once in each 3-year period.

State loam, rolling phase (Slo) (slope, 7 to 15 percent).—Although resembling the undulating phase in profile characteristics, this soil differs in having stronger surface relief. External and internal drainage are moderate. Where not heavily limed or fertilized the soil is medium acid and is moderate to low in mineral plant nutrients. It has a relatively low content of organic matter.

Throughout its extent this phase is uniform in development, and only slight variations occur from place to place in color, texture, and other profile characteristics. Areas totaling about 141 acres that have been eroded to some extent and in a few places have lost as much as 75 percent of the original surface soil are included. In some of these eroded areas the subsoil is within plow depth. Also included are areas totaling about 146 acres that are gravelly enough to interfere to some extent with tillage. The gravel is partly rounded and ranges from less than 1 inch to 3 inches in diameter.

State loam, rolling phase, is very well suited to the production of most crops grown in the county and can be used for fairly short crop rotations. Practically all areas have been cleared and are used for crops. As the included eroded areas indicate, the soil is subject to erosion if not managed properly. With a rotation in which at least one leguminous cover crop is turned under in each 3-year period and the crop rows are across and not up and down the slope, the soil can be used to good advantage for growing row crops.

State gravelly loam, undulating phase (Sgu) (slope, 3 to 7 percent).—Unlike the other State soils this phase has enough gravel on the surface and in the soil to interfere with tillage. External drainage is moderate and internal drainage moderate to rapid. Except where heavily fertilized and limed, the soil is medium to strongly acid and medium in content of mineral plant nutrients and organic matter.

Included because of small total extent are a few small areas that have lost as much as 25 percent of the original surface soil by accelerated erosion. This loss has impaired the soil very little for crops or pasture, but it is an indication that a serious erosion problem may arise unless proper soil management is observed.

Although State gravelly loam, undulating phase, is not so desirable for crops as State loam, undulating phase, mainly because of some difficulty in tilling, it is suited to the growth of corn, small grains, alfalfa, clover, and grass, and the yields of these crops generally are very satisfactory. In managing this soil it seems best not to grow corn for two years in succession; the better practice would be to alternate corn with small grain or clover.

Stony colluvium (Tusquitee soil material) (ScT) (slope, 1 to 15 percent).—This very stony land type consists of colluvial and local alluvial material that originated in Porters and Halewood soils. In some places, however, the material is largely alluvial, and is very much like Congaree soil. The surface relief ranges from nearly level to strongly rolling or sloping. External drainage is moderate and internal drainage moderate to rapid. Areas occur on foot slopes of mountains and along many of the streams. Along some streams the soil is similar to Congaree fine sandy loam, but numerous rock fragments up to boulders in size are on the surface and throughout the profile. Other areas consist of riverwash, a brown material including sand, pieces of gravel, and subangular rock fragments.

The characteristic feature of this land type is the great quantity of flat, rounded stones, which range in diameter from ½ to 15 inches or more and average about 6. The 8- to 15-inch surface soil consists of brown to dark-brown friable loam and contains a large quantity of organic matter. Below this layer to a depth of 23 to 26 inches the material is similar to that of the surface soil but is lighter in color and contains less organic matter. This layer rests on dark-colored hard and soft rock fragments that overlie bedrock. Locally a fairly large quantity of organic matter derived from the decay of plant remains is on the surface. Rock outcrops occur in places.

Most of Stony colluvium (Tusquitee soil material) is used for pasture or forest. A few small areas are used for crops, mainly corn, but the many stones on the surface and in the soil nearly everywhere prevent tillage operations. In some areas it might be feasible to remove enough stones for the land to be cultivated. Stones have been gathered from a number of places for use in constructing dwellings and other buildings and in making fences.

Stony rough land (Porters and Ramsey soil materials) (SrP) (slope, 30 to 60 percent +).—Areas of Porters and Ramsey soils that occur on steep to very steep relief and contain numerous large angular rock fragments up to boulders in size and many bedrock out-

crops are classified as this land type. In places the slopes are broken or almost precipitous. Little or no definite soil has formed in any of the areas, and in most places the soil material is Porters or Ramsey; in a few areas, Ashe or Halewood; and in places on some of the highest mountains, Burton. External drainage is rapid and internal drainage moderate.

This is the most extensive unit mapped in the county, and large areas are on the more rugged mountains. Practically all of it is in hardwood forest, with an open to moderately dense undergrowth of mountain-laurel and rhododendron on the less stony areas. The most feasible use for this land type is forest, although owing largely to the rough country and the poor quality of much of the timber, the trees are left standing in many places and are removed only from the more accessible areas.

Tate silt loam, rolling phase (Tmo) (slope, 2 to 15 percent).—This phase is derived from colluvial materials washed chiefly from Ramsey soils and in most places is on foot slopes associated with Ramsey soils. Areas are on gently sloping to sloping or rolling relief along streams and in flats in the northern part of the county. External and internal drainage are slow to moderate. The soil in undisturbed woodland is strongly acid and has a fair content of organic matter throughout the profile. The original forest growth consisted largely of maple; poplar; chestnut; locust; and post, white, and chestnut oaks; with an undergrowth of dogwood, mountain-laurel, rhododendron, and huckleberry bushes.

A profile description in a wooded area is as follows:

0 to 8 inches, brownish-gray friable silt loam containing a moderate quantity of organic matter and some small mica flakes and shale fragments.
8 to 32 inches, brownish-yellow silty clay loam to silty clay; slightly sticky and plastic when wet and friable when dry; breaks under moderate pressure to nutlike fragments; some small mica scales and some shale or slate fragments are in the material.
32 inches +, mottled gray, brown, and yellow friable to very slightly plastic silty clay loam or silty clay that contains numerous shale particles.

Throughout its extent this rolling phase varies considerably in color, depth of profile, and content of organic matter. The range in color is from grayish yellow to brownish yellow to yellow, in depth over bedrock from 18 to 40 inches, and in organic matter from low to high.

Included because of similarity of profile are areas totaling about 37 acres that are on high terraces and have gray fine sandy loam surface soil and yellowish loam to sandy clay loam subsoil. This included soil has been formed from old alluvium, mainly from Ramsey soils. It is a member of the Holston series, but its total area is not large enough to justify mapping as a separate soil. Other included soil, totaling about 224 acres, consists of slightly to moderately eroded areas of the rolling phase.

Although Tate silt loam, rolling phase, is well suited to the production of most crops grown in the county, nearly all of it is within the boundary of the Great Smoky Mountains National Park and is permanently removed from agricultural use.

Tate silt loam, hilly phase (Tml) (slope, 15 to 30 percent).—Stronger relief and a somewhat more shallow profile over bedrock differentiate this soil from the rolling phase. External drainage is

moderate and internal drainage moderate to slow. The soil is strongly acid, medium in mineral plant nutrients, and moderately high in organic matter. It supports a mixed hardwood forest and occurs along streams and in flats in association with other Tate soils and with Ramsey soils. In some places shale fragments are on the surface, but they are not of sufficient quantity to interfere with tillage.

Included because of small extent are about 104 acres that have been cleared and farmed and in places have lost 25 to 75 percent of the original surface soil by accelerated erosion. Practically all areas of this phase are in the Great Smoky Mountains National Park and are permanently removed from agricultural use.

Tate stony silt loam, rolling phase (Tso) (slope, 7 to 15 percent).—Areas of this soil occur in association with other Tate soils and with Ramsey soils. It has slightly less depth to bedrock than the rolling phase of Tate silt loam. Sufficient rock fragments, ranging from small pieces of shale to large sandstone or quartzite boulders, are on the surface and in the soil to interfere with tillage. External drainage is slow to moderate and internal drainage moderate. The soil is strongly acid, has a fairly high content of organic matter, and is medium to low in mineral plant nutrients. In most places it supports a forest of mixed hardwoods, consisting largely of oaks.

About 68 acres on terraces are included because of a small total extent. The soil in these areas is derived from old alluvium and has a gray or grayish-yellow fine sandy loam surface soil and a yellow fine sandy clay subsoil. It would have been mapped as Holston gravelly fine sandy loam, rolling phase, had its extent been larger. Other inclusions, totaling about 319 acres, are eroded areas of the rolling phase that have been cleared for agricultural use and have lost up to about 75 percent of the original surface soil.

Practically all of Tate stony silt loam, rolling phase, is mapped in the Great Smoky Mountains National Park, and most of it is not available for farming.

Tate stony silt loam, hilly phase (Tsl) (slope, 15 to 30 percent).—Stoniness, stronger slopes, and a shallower profile over bedrock differentiate this soil from Tate silt loam, rolling phase. Stones, ranging from small shale fragments to large sandstone or quartzite boulders on the surface and in the soil, interfere materially with tillage. External and internal drainage are moderate. The soil is strongly acid and has a medium content of mineral plant nutrients, and, except in the subsoil, a fairly high content of organic matter. This phase occurs in association with other Tate soils, mainly in the Great Smoky Mountains National Park. It is not available for agricultural use.

Areas totaling about 155 acres that have been cleared and used for crops or pasture and as a result have lost up to 75 percent of the surface soil are included. In many places the subsoil is within a few inches of the surface. Also included is a total of about 12 acres of alluvial material on terraces near streams. The soil over this material belongs to the Holston series and has a yellowish-gray gravelly fine sandy loam surface soil and a yellow sandy clay subsoil.

Toxaway silt loam (Tx) (slope, 0 to 2 percent).—This poorly drained soil of the first bottoms was formed from alluvial material

derived from uplands underlain mainly by light-colored gneiss, granite, or schist. The soil is level or nearly level and is subject to overflow. External drainage is slow to very slow and internal drainage very slow. According to a number of soil tests, the soil is strongly acid, low to medium high in calcium and magnesium, medium in nitrogen, low to very low in phosphorus and potash, and high in organic matter. The original vegetation was water-loving and included willow, willow oak, beech, birch, and ash. In many places there was a thick undergrowth of rhododendron and mountain-laurel.

The following profile was taken in a cultivated field:

0 to 8 inches, dark-gray to almost black friable silt loam of soft medium-granular structure; rich in organic matter.
8 to 26 inches, almost black heavy silt loam with a smooth or slick feel; very rich in organic matter.
26 inches +, bluish-gray very micaceous silt loam, streaked with brown or yellowish-brown and apparently containing much organic matter.

Variations occur in drainage conditions, since some areas are higher above the streams than common for the soil and less subject to overflow.

All areas of Toxaway silt loam have been cleared and used for crops. Where adequately drained, the soil is well suited to corn, soybeans, potatoes, green beans, and hay. Generally it is considered one of the best soils in the county for corn and makes excellent response to good management, which for a great many areas includes artificial drainage. It can be used for very short crop rotations. On many farms it could be used to good advantage for row crops, thereby making available more upland for close-growing crops.

Tusquitee loam, rolling phase (Tlo) (slope, 7 to 15 percent).—This phase is derived from colluvial material washed or rolled from the adjoining slopes on which the soils are underlain by crystalline rocks. It occupies foot slopes and occurs in association with Porters, Hayesville, and Halewood soils. External and internal drainage are moderate. As determined by tests of representative samples, the soil is medium to strongly acid, medium low to very low in calcium, medium to low in magnesium, very low to low in phosphorus, very low to medium in potash, and high in organic matter. In uncleared areas the trees consist principally of maple; poplar; locust; and post, white, and chestnut oaks; with an undergrowth largely of dogwood, mountain-laurel, rhododendron, and huckleberry bushes.

A profile taken in a cultivated field is as follows:

0 to 13 inches, dark-brown friable loam containing some mica flakes.
13 to 32 inches, brown to yellowish brown friable clay loam containing some mica flakes.
32 inches +, brown and yellow loam somewhat streaked or mottled; grades at varying depths into loose rock fragments.

This phase is very uniform in profile characteristics. The most noticeable variation is in the depth to rock fragments, which ranges from 20 to 60 inches and averages about 32. In some areas there are recent deposits of colluvial material, more friable than the older underlying material. About 1,045 acres have been cleared and cultivated, and consequently in some areas the soil has lost by accelerated erosion up to 75 percent of the surface soil, leaving the subsoil within plow depth in many places. Erosion has not greatly impaired the soil in most places, but good management is necessary for controlling water on the land.

Tusquitee loam, rolling phase, is fertile and easily worked and is one of the better soils in the county for practically all crops commonly grown. It can be used intensively for growing clean-cultivated crops if a suitable crop rotation is followed, the crop rows are along the contour, and a leguminous winter crop is turned under once in every 3 years.

Tusquitee loam, undulating phase (Tlu) (slope, 2 to 7 percent).—This phase differs from the rolling phase in relief and greater depth of profile over rock fragments. Largely because of gentle slopes it is only moderately susceptible to erosion. External and internal drainage are moderate. The soil is medium to strongly acid and has a moderate supply of mineral plant nutrients and a relatively high content of organic matter.

The profile characteristics are very uniform, and the color, texture, structure, and depth to rock fragments are similar in all areas. A few pieces of gravel or stones are on the surface and in the soil in some places but are rarely in sufficient quantity to interfere with tillage. About 754 acres have been cleared and cultivated and have lost up to 25 percent of the surface soil by erosion. On about 12 acres up to 75 percent of the surface soil has been lost by erosion, leaving the subsoil within plow depth.

Tusquitee loam, undulating phase, is well suited to all crops commonly grown but is mostly in hardwood forest. It can be used for fairly short crop rotations without serious erosion and is especially well suited to corn, truck, tobacco, and hay crops (pl. 5, *A*). Although erosion has not impaired the soil very much for crop use, its presence is an indication that it may be expected to do so eventually under poor management. The loss of organic matter has reduced the capacity of the soil to absorb and retain moisture.

Tusquitee loam, hilly phase (Tll) (slope, 15 to 30 percent).—Areas of this soil are on mountain slopes in association with the Tusquitee soils and Porters and Hayesville soils. The forest growth consists largely of oak, maple, poplar, and beech. This phase differs from the rolling phase mainly in having stronger slopes and in being somewhat more shallow to rock fragments. External drainage is rapid and internal drainage moderate. The soil is strongly acid and has a high content of organic matter and a medium to low content of mineral plant nutrients.

A few pieces of gravel are on the surface and in the soil in places, but there is not enough to interfere with tillage. Included because of limited extent are areas totaling about 171 acres that have been cleared and cultivated. As a result these areas have become moderately eroded, and in a few fields up to 75 percent of the surface soil has been removed.

Many areas of Tusquitee loam, hilly phase, could be cleared for pasture or for small-grain and hay crops, and under proper management the yields should be good. If the soil is used for long crop rotations, an occasional intertilled crop could be grown, but measures would be necessary for controlling erosion.

Tusquitee stony loam, rolling phase (Tto) (slope, 7 to 15 percent).—Stoniness and a somewhat shallower profile are the principal differences between this phase and Tusquitee loam, rolling phase. The

stones on and in the soil range from gravel to boulders several feet in diameter and are sufficient to interfere greatly with tillage. External and internal drainage are moderate. The soil is strongly acid and has a medium supply of mineral plant nutrients and a moderately high content of organic matter. The native vegetation consisted chiefly of mixed hardwoods.

Included are about 1,363 acres of slightly eroded areas that have lost up to 25 percent of the surface soil. Other eroded areas included are about 251 acres where up to 75 percent of the original surface soil has been lost and the subsoil is within plow depth. This loss of material indicates that despite the rather high content of stones on the surface and in the profile, the soil is subject to erosion and has been impaired to some extent. The loss of organic matter in the eroded areas has decreased the capacity of the soil to absorb and retain moisture.

Nearly all of Tusquitee stony loam, rolling phase, is cleared land used for pasture and crops, generally corn, hay, and tobacco, which are fairly well suited to the soil. The soil is very desirable for apple orchards. Where sufficient labor is available, the removal of some of the stones would greatly improve the suitability of the soil for tilled crops.

Tusquitee stony loam, eroded rolling phase (Ttg) (slope, 7 to 15 percent).—This eroded rolling phase differs from Tusquitee loam, rolling phase, in having enough stones of varying sizes on the surface and in the soil to interfere with tillage, and in the loss of 25 to 75 percent of the original surface soil by accelerated erosion. Although the quantity of the surface soil removed by erosion varies greatly, in most areas the subsoil is within plow depth and the surface soil heavier and of somewhat lighter color. External and internal drainage are moderate. Where not heavily limed and fertilized, the soil is medium to strongly acid and low to medium in content of mineral plant nutrients. The organic-matter content is somewhat low because of erosion.

Areas having slopes of 3 to 7 percent are included because of small extent. About 9 included acres are not eroded to any appreciable degree, and 28 acres have lost up to about 25 percent of the surface soil by erosion.

All areas of Tusquitee stony loam, eroded rolling phase, are cleared and in agricultural use. The soil is well suited to the growth of most crops common to the area, but owing to stone content much of the tillage must be by hand. Were the stones removed, it would be one of the more desirable soils and could be used intensively for truck crops, corn, and tobacco in short rotations. Even in its stony condition it is highly prized for pasture. Although the moderate erosion has not seriously affected productivity, further erosion will render the soil less productive, and measures are necessary for controlling runoff. The loss of surface soil has materially reduced the capacity of the soil to absorb and retain moisture.

Tusquitee stony loam, hilly phase (Ttl) (slope, 15 to 30 percent).—Except for the stones present, this soil has a profile similar to that of Tusquitee loam, rolling phase. There are enough stones of varying sizes on the surface and in the soil to interfere materially with tillage. External drainage is moderate to rapid and internal drainage moderate. The soil is strongly acid, medium to high in organic matter, and

medium in mineral plant nutrients. The forest is mostly mixed hardwood. About 738 acres are included that have been cleared of forest for agricultural use and as a result have lost about 25 percent of the original surface soil.

Largely because of stony condition and strong slopes, Tusquitee stony loam, hilly phase, must be tilled mostly with hand implements (pl. 5, *B*). The soil is poorly suited to intertilled crops but fairly well suited to pasture. Where labor is available for removal of enough of the stones, many areas could be cleared and used for pasture, hay, or small grains.

Tusquitee stony loam, eroded hilly phase (Tth) (slope, 15 to 30 percent).—This phase differs from Tusquitee loam, rolling phase, mainly in having stronger slopes, a high content of stone, and moderate erosion. Like the other stony Tusquitee soils, enough stones of variable sizes are on the surface and in the soil to interfere to some extent with tillage. Accelerated erosion has removed 25 to 75 percent of the original surface soil, and the subsoil is usually within plow depth. A few gullies have formed that are crossable with farm machinery but in most places are not obliterated by tillage. External drainage is moderate to rapid and internal drainage moderate. Except where limed and fertilized, the soil is strongly acid and low in mineral plant nutrients and organic matter.

All of this eroded hilly phase has been used at some time for crops or pasture, but under improper management it has been considerably eroded. Now the soil is fair for the production of legumes and grasses for pasture or hay but could be improved greatly by the removal of the stones from the surface and surface soil. Largely because of strong slopes, the presence of stones, and eroded condition, the soil is poorly suited to intertilled crops, and the areas planted to such crops are better suited to permanent sod.

Warne silt loam (Ws) (slope, 0 to 7 percent).—This level to gently rolling soil occurs in small scattered areas on low terraces along the larger streams in association with State, Altavista, and Congaree soils. It has formed from alluvial material derived from upland soils underlain by crystalline rocks. External drainage is very slow to slow and internal drainage very slow. Samples taken from cultivated fields indicate that the soil is medium to strongly acid; medium to low in calcium, magnesium, and nitrogen; very low to low in phosphorus; very low to medium in potash; and medium to low in organic matter. Before being cleared for agricultural use the soil supported a hardwood forest mostly of oak, maple, poplar, and some chestnut.

The following profile was taken in a cultivated area:

0 to 10 inches, gray friable silt loam.
10 to 25 inches, mottled gray and brownish-yellow heavy plastic silty clay to clay, very hard on drying; some finely divided mica flakes are present.
25 inches +, mottled gray and brownish-gray heavy plastic silty clay to clay.

The main variations are in the thickness of the surface soil and in external drainage, which depends largely on the slope. In some places gravel is on the surface and in the soil. Areas of Warne fine sandy loam totaling about 35 acres, which differ from Warne silt loam mainly in having a coarser surface soil, are included.

Largely because of poor drainage Warne silt loam is restricted in use for crops. If the soil is used for row crops, the ridge method of

tillage seems to be a good management practice. Generally, open ditches are needed to remove excess water from the surface. Where drainage is made adequate, the soil is suitable for corn, hay crops, and small grains, although the crops may be damaged to some extent during extremely wet periods. The soil is well suited to pasture (pl. 4, *C*).

Wehadkee fine sandy loam (Wf) (slope, 0 to 2 percent).—This poorly drained soil on first bottoms is subject to periodic overflow. Areas are associated with Congaree soils along the larger streams. The surface is nearly level, and both external and internal drainage are very slow to ponded. The water table is generally near the surface. The soil is medium to strongly acid; medium to very low in calcium; low to medium in magnesium; medium in nitrogen; low to very low in phosphorus; low in potash, and medium to fairly high in organic matter. Before being cleared for agricultural use, the vegetation was a heavy growth of water-loving trees, as alder, willow, and hornbeam.

A soil profile in a pastured area is as follows:

0 to 6 inches, brownish-black fine sandy loam with some gray and brown mottling.

6 to 20 inches +, gray, mottled with brown, compact silt loam or loam containing numerous finely divided mica flakes; the water table is at a depth of about 10 inches.

In some areas the soil is somewhat higher above streams than elsewhere. A few areas have a silt loam surface soil.

Practically all areas of Wehadkee fine sandy loam have been cleared and at some time used for crops and pasture. Mainly because of poor drainage the soil is now used for pasture, although much of the pasture land is growing up in bulrush, willow, and alder. The soil is poorly suited to crops and to grasses for forage, most of the grasses being the coarse water-loving type not desirable for cattle. Adequate drainage is difficult to obtain because of the extremely high water table and the low elevation of the soil above the streams. With heavy liming and adequate drainage this soil will produce fair pasture in years when rainfall is below normal.

USE, MANAGEMENT, AND PRODUCTIVITY OF THE SOILS [8]

The major uses and management requirements of the soils and their productivity are discussed in this section in order that their interrelations can be understood. The term "land use" refers to such broad uses of soils as (1) crops, including tilled crops, row crops, small grains, and annual hay; (2) permanent pasture; and (3) forest. The term "soil management" refers to such practices as (1) the choice and rotation of crops; (2) the use of lime, fertilizer, and manure; (3) tillage; and (4) engineering as a supporting measure for water control. An ideal soil for agriculture is one that is very productive of a large number of important crops, easily worked, and capable of being conserved with a minimum of effort. All the soils of this

[8] This section was prepared in April 1948 and revised in November 1949 by representatives of the North Carolina Agricultural Experiment Station. The fertilizer applications given are those recommended in 1949. For more recent information, see your county agent or write to the North Carolina Agricultural Experiment Station, Raleigh, N. C.

county fall short of this, but they differ widely in the degree of such shortcoming. For example, a soil may be highly productive and easily conserved but difficult to work.

USE CLASSES AND MANAGEMENT GROUPS OF SOILS

The soils of Haywood County have been grouped in five classes on the basis of their relative suitability for agricultural use. In the order of decreasing desirability for use in the present agriculture, these classes are First, Second, Third, Fourth, and Fifth. Although the soils of no one class are ideal for the existing agriculture, the First-class soils more nearly approach that condition than do the Second-class soils. Likewise, the soils of each succeeding class are farther from that ideal than those of the preceding class.

The physical suitability of an individual soil for agricultural use is determined by its characteristics. Many soil characteristics contribute to its productivity, workability, and conservability.

The relative suitability of the soils for agricultural use has been evaluated on the basis of the experience of farmers, extension workers, experiment station personnel, vocational agriculture teachers, soil surveyors, and others who work with soil. For example, a farmer knows that some soils on his farm are more desirable for certain crops than others. By comparisons of this nature within farms and among farms, the soils may be ranked in the order of their desirability for the agriculture of the area under present conditions. In this county cattle are fairly important on many farms, and suitability of soils for permanent pasture has been considered in determining the rank of each soil in this classification. Where information based on experience with a soil is lacking, the soil may be ranked by comparisons with other soils with similar characteristics for which information is available.

In the following pages the five land classes are separately discussed, each discussion being followed by a table in which the soils of the particular class are grouped together according to similarity in management requirements. In addition, present use data are given for each soil. Following each table are separate discussions of the management groups, in which the characteristics, present use and management, and management requirements for each are presented.

FIRST-CLASS SOILS

First-class soils are good to excellent cropland and very good to excellent for pasture. Although differing somewhat in their characteristics, they are relatively similar in physical suitability for agricultural use. Each is moderately well supplied with plant nutrients, and the natural productivity is fairly high compared with that of other soils of the county. Even the most fertile soil of this group, however, is responsive to additions of certain amendments for some crops. All are well drained, yet their physical characteristics are such that they retain moisture fairly well and thereby tend to insure a rather even and generally adequate supply for plant growth. Good tilth is easily maintained, and the range of moisture conditions for tillage is comparatively wide. The soils are moderately well supplied with organic matter, and their physical properties are favorable to the movement of air and moisture and to the free penetration of roots

into all parts of the subsoil. None has any adverse condition or property, as stoniness, poor tilth, or unfavorable relief; the problem of conserving fertility and soil material is relatively simple; and each is capable of intensive use if appropriate management practices are carried out.

The First-class soils are listed by management groups, and the estimated percentage of each soil used for crops, idle cropland, open pasture, and forest in 1946 is given in table 4. Suitable crops, recommended rotations, and soil amendments are given in tables 9 and 10.

TABLE 4.—*Estimated percentage of each First-class soil in crops, idle cropland, open pasture, and forest in Haywood County, N. C., in 1946, by management groups*

Management group and soil	Crops	Idle cropland	Open pasture	Forest
	Percent	*Percent*	*Percent*	*Percent*
GROUP 1–A:				
Balfour loam, rolling phase	------	------	------	100
Tusquitee loam:				
Rolling phase	30	------	25	45
Undulating phase	40	5	25	30
Tate silt loam, rolling phase	25	5	25	45
State loam:				
Undulating phase	65	5	30	------
Rolling phase	75	5	20	------
GROUP 1–B:				
Masada loam:				
Undulating phase	85	5	10	------
Rolling phase	85	5	10	------
Altavista silt loam	95	5	------	------
Altavista fine sandy loam	95	5	------	------
GROUP 1–C:				
Congaree fine sandy loam	95	5	------	------
Congaree silt loam	95	5	------	------

MANAGEMENT GROUP 1–A

The stone-free soils of management group 1–A are undulating to rolling, well-drained, and relatively fertile. They are permeable, easily penetrated by water, air, and roots; and retentive of moisture for plant growth. All are productive, easily worked, and conserved with relative ease. These soils are similar in that they have a medium-textured brown to grayish-brown friable surface soil and brown friable clay loam subsoil. They contain moderate quantities of organic matter but are strongly acid and somewhat deficient in phosphorus, nitrogen, and usually in potassium.

Many areas are in cropland or open pasture; several small parts are in woods; and a very few are idle. Corn, small grain, hay, and vegetables are the principal crops, with a little tobacco being produced. A systematic rotation is not generally practiced. Sometimes one row crop is alternated with another, but it is common for a crop to be grown 2 or 3 years in succession. The more common rotations are (1) potatoes, rye or wheat, lespedeza or clover for 2 years, (2) tobacco,

rye, clover and timothy or lespedeza, (3) corn, rye, corn, and (4) corn, crimson clover, and corn.

Land for corn following a heavily fertilized crop is generally treated with 200 to 300 pounds of 18-percent superphosphate or its equivalent and manure is added when available. When corn follows a lightly fertilized crop an average application of 300 to 500 pounds of 6–8–6, 4–12–8, or 6–6–12 fertilizer is used. Vegetable crops are fertilized rather heavily, applications of 400 to 600 pounds of 6–8–6 being average. Some farmers apply 1,000 to 2,000 pounds of lime an acre for truck crops, except potatoes, but very little lime is used for other crops. No special tillage practices are followed. Usually land is broken in spring for row crops, and it is not uncommon to carry on tillage with little consideration of slope or lay of the land.

These soils are suitable for intensive use and are responsive to good management. The State, Tate, and Tusquitee soils are particularly well suited to corn for silage or grain, truck crops, and small grain, as well as burley tobacco, clover, grass, and alfalfa. The Balfour is well suited to corn, tobacco, and hay crops. All are excellent for pasture but in most cases are best used for intensive cropping, since on most farms a much greater proportion of other soils is not so well suited to crops although well suited to pasture under good management.

Applications of lime produce favorable results on these medium to strongly acid soils. For alfalfa or red clover an initial acre application of about 2 tons of ground limestone is generally needed, but soil tests should be made to determine the proper quantity. All the soils have a favorable ratio of nitrogen, phosphorus, and potash; but the total content is not very high.

Required water control measures are not exacting, although contour tillage should be diligently practiced on the more sloping parts. All the soils are easily plowed and cultivated with light to moderately heavy implements. Additions of organic matter will improve the water-holding capacity and should increase crop yields. Legume cover crops are of special value for this purpose as well as for maintaining the general fertility and reducing plant nutrient losses by leaching. Special suitabilities, recommended rotations, and soil amendments are given in tables 9 and 10.

When the soils are used for pasture, some of the better farmers receive very good results from liberal applications of lime and phosphate where the pasture plants are well balanced between legumes and grasses. Applications of about 1 to 2 tons of ground limestone at intervals of 6 to 8 years and of 400 to 500 pounds of 18-percent superphosphate, or its equivalent, per acre at intervals of 3 years should prove satisfactory. Applications of potash probably will be needed in many places. Pastures should be clipped to control weeds, and care should be taken to guard against either overgrazing or undergrazing.

MANAGEMENT GROUP 1–B

The four soils making up management group 1–B are on the Masada and Altavista series. All the soils have undulating to rolling slopes, are free of stone, unimpaired by erosion, and range in texture from silt loam to fine sandy loam. They are relatively low in organic matter and less fertile than the soils in management group 1–A,

are strongly acid, and have physical properties favorable to the penetration of water, air, and roots. The general character of these soils is such that tillage can be carried on satisfactorily within a fairly wide range of moisture conditions.

Practically all areas of these soils are in cropland, principally corn, small grain, hay, and vegetables, with only small bodies used for pasture or lying idle. Rotation systems are not generally followed. Row crops may be alternated, but the same crop commonly is grown 2 years or more in succession. Some of the rotations are (1) tobacco, rye, lespedeza or clover, and corn, (2) potatoes, rye or wheat, lespedeza or clover for 2 years, (3) corn, rye, corn, and (4) corn, crimson clover, corn.

Land for corn is commonly treated with 200 to 300 pounds an acre of 18-percent superphosphate, its equivalent, or 200 pounds of a complete fertilizer, as 4–12–8 or 4–12–4. Manure is added when available. When vegetable crops are grown they are fertilized heavily—generally with 400 to 600 pounds of a 6–8–6 or 4–12–4 mixture. Some farmers apply from ½ to 1½ tons of ground limestone per acre to land used for legume and truck crops, but generally very little lime is used for other crops on soils of this group. No special tillage practices are consistently followed. Usually land is broken in the spring for row crops, and rows are laid out with little regard for the direction of slope or lay of the land.

The favorable nature of these soils makes them suitable for intensive use under proper management. The Masada soils are well suited to corn, small grain, burley tobacco, and alfalfa, grass, and clover hay crops. The Altavista soils are well suited to vegetables, corn, and hay crops, especially grasses. All are excellent for pasture but are probably best used fairly intensively for crops requiring tillage, since on most farms soils well suited to cultivation are very limited as compared to those better suited to pasture.

Lime gives favorable results on these medium to strongly acid soils, and for alfalfa or red clover an initial acre application of 1½ to 2 tons of ground limestone is generally needed. All the soils have a favorable ratio of nitrogen, phosphorus, and potash, but their total content is not high. All of them respond well to proper fertilization. A legume turned under in the rotation is beneficial, since it supplies organic matter and nitrogen and helps reduce leaching of plant nutrients.

Required water control practices are not exacting, although contour tillage should be diligently practiced on the more sloping parts. Light to moderately heavy implements and work stock are sufficient. Although the Masada soils have a moderately wide tillage range, they should not be tilled when wet.

On some farms it is convenient to use these soils for pasture. Good management for permanent pasture usually requires seeding a grass-legume mixture, as bluegrass, orchard grass, Korean lespedeza, Ladino clover, and white clover, and application of 1 to 2 tons of ground limestone at intervals of 6 to 8 years and 400 to 500 pounds of 18-percent superphosphate or its equivalent at intervals of about 3 years. Potash needs should be watched and cared for. An initial application of manure or nitrogen would be effective in establishing the cover, especially on the rolling Masada loam. A high level of management

will require weed control by clipping and careful regulation of grazing, particularly in periods of low rainfall during the first few months when the pasture plants are getting established.

MANAGEMENT GROUP 1–C

The nearly level soils of management group 1–C are friable and well-drained but are subject to overflow. They are similar except in texture and retain moisture and plant nutrients well. Control of runoff is no problem, and management is relatively simple. The soils are strongly acid where they have not been limed in recent years. Although somewhat deficient in nitrogen, phosphorus, and potassium, they have a normally higher content than upland soils. During occasional flooding they receive deposits of fresh alluvium, which is probably better balanced in plant nutrients than the higher lying soils.

These soils are generally in crops, mostly corn and small grain, with rye, oats, lespedeza, and tobacco as minor crops. They are especially well suited to corn, grass for meadow or pasture, and truck crops. No systematic rotation is in general use. Corn frequently follows corn or rye, or crimson clover is grown on the cornland. In some places rye or oats may be cut for hay, whereas in others the crops are grazed, turned under, and followed by corn. A somewhat common practice is to follow crimson clover with corn, after turning under the clover. On a few farms potatoes are followed by rye and lespedeza or clover. The legume is kept on the land for 1 or 2 years before corn is planted.

Only a small quantity of amendments is added to land for corn and crimson clover. Potatoes and truck crops are heavily fertilized, usually with 500 to 800 pounds of 4–12–4 or 6–8–6. Little or no manure is applied. Lime is used for truck crops but not generally for potatoes because of the risk of diseases. In most places small grains receive 300 to 400 pounds of 0–18–0 an acre. No special tillage practices are followed, and the land is generally broken late in winter or early in spring.

The soils may be used intensively because they occupy favorable positions and are well-drained and easily tilled yet not subject to severe leaching. The average farm has only a very small acreage of such soils, but these limited areas can produce much of the corn, truck, and other row crops needed. The soils in this group are well suited to the growth of corn for grain or silage, and they are very desirable for vegetables and for pasture or hay. When possible, however, uplands should be used for sod-forming crops, and these soils for row crops.

Such crops as crimson clover and lespedeza respond readily to applications of 1 ton of limestone, applied at 4- to 6-year intervals. It is better to use soil tests before making heavy lime applications. Farmers who get favorable yields of corn, small grain, and hay apply some phosphate and a little potash to the land before planting the grain crop and add nitrogen as a top dressing. When legumes grown in the rotation are turned under, the nitrogen that is added to the soil is very beneficial to the corn crop that follows. No special tillage practices are required on these soils. Light implements may be used, and deep plowing is not necessary.

Although the two soils in this group are generally used for row crops, they are excellent pasture soils and in a few places are used occasionally for this purpose. The best management for permanent pasture requires applications of 1 to 2 tons of ground limestone at intervals of 6 or 8 years and applications of 400 to 500 pounds of 18-percent superphosphate or its equivalent at intervals of about 3 years. In places potash will also be needed. The pasture plants should be well-balanced between grasses and legumes, and weeds should be kept down by clipping. These soils are not materially injured by trampling, even when moist.

SECOND-CLASS SOILS

Second-class soils are fair to good cropland and good to excellent pasture land. They have a greater diversity of characteristics than the First-class soils. Although comparatively similar to one another in their suitability for agricultural use, they differ somewhat in productivity, workability, and conservability, and each soil is moderately deficient in one or more of these conditions. The detrimental effect of such deficiencies upon the suitability of the soil for agricultural use is greater than that of any of the First-class soils but less than for any of the Third-class.

These soils are listed by management groups, and the estimated percentage of each soil in crops, idle cropland, open pasture, and forest in 1946 is given in table 5. Suitability for special crops and recommended rotations and soil amendments are given in tables 9 and 10.

TABLE 5.—*Estimated percentage of each Second-class soil in crops, idle cropland, open pasture, and forest in Haywood County, N. C., in 1946, by management groups*

Management group and soil	Crops	Idle cropland	Open pasture	Forest
GROUP 2–A:	*Percent*	*Percent*	*Percent*	*Percent*
Halewood loam:				
Rolling phase	10	5	20	65
Eroded rolling phase	50	5	45	----
Hayesville loam, rolling phase	10	5	10	75
Hayesville clay loam, eroded rolling phase	75	5	20	----
Hiwassee clay loam, eroded rolling phase	70	5	25	----
Masada clay loam, eroded rolling phase	85	5	10	----
GROUP 2–B:				
Tusquitee stony loam:				
Rolling phase	25	5	20	50
Eroded rolling phase	55	5	40	----
Tate stony silt loam, rolling phase	30	----	20	50
State gravelly loam, undulating phase	45	5	50	----
GROUP 2–C:				
Congaree gravelly fine sandy loam	55	5	40	----
Toxaway silt loam	95	5	----	----
Congaree-Toxaway silt loams	95	5	----	----

MANAGEMENT GROUP 2-A

The stone-free soils of management group 2–A have 8- to 15-percent slopes and are well to somewhat excessively drained. They have a

A, Potatoes growing on Tusquitee loam, undulating phase.
B, Tusquitee stony loam, hilly phase, used intensively for a garden because of the limited acreage of mountainous soils well suited to tilled crops.

A. Potatoes on Ashe stony loam, very steep phase. Fall cabbage may follow. Such intensive use of this soil is not advisable.

B. Excellent 2-year-old pasture of orchard grass and Ladino clover on Halewood soils.

brown to reddish-brown loam or clay loam surface soil and a yellowish-brown to reddish-brown clay loam or clay subsoil. Their physical characteristics are moderately favorable to the penetration of water, air, and roots, and they can be tilled satisfactorily under a moderately wide range of moisture conditions—the three loam soils within a little wider range than the three clay loam soils. All soils of this group are moderate to low in organic matter, strongly acid, and somewhat deficient in most plant nutrients but very responsive to good management.

The soils are used for general farming—corn, small grain, and lespedeza being the principal crops. Systematic rotations are not commonly practiced, but on some farms corn is followed by small grain and lespedeza. In this rotation the first crop of lespedeza is cut for hay, whereas the second is often saved for seed and turned under. On a few farms a short rotation of corn, crimson clover, and corn is followed.

Corn is generally fertilized with 200 to 400 pounds of a 4–12–8, 4–12–4, or a similar mixture. When available, manure is added to cornland in spring. Small grains receive about 300 pounds of 0–18–0 when sown in fall, and on many farms an application of nitrogen is added as a top dressing in spring. On a few farms lime is applied to cropland. Common tillage practices include breaking land in spring and running rows the most convenient way on the less sloping areas. A few farmers, however, practice tillage along the contour, especially on the more sloping areas.

Soils of this group are suitable for alfalfa, wheat, barley, clover, grass, and vegetables. Corn yields are fairly high when the crop follows a turned-under legume and rainfall is sufficient. Apple orchards would probably bring good returns, as indicated by the growth and apparent yields of the few small farm orchards on similar soils in Haywood County and in nearby counties.

Rotations suggested for soils of this group are for general farming. Corn, small grain, and 2 years of lespedeza usually meet the requirements of the average farm having principally these soils. A rotation of 4 years of alfalfa, followed by corn, small grain, and 1 year of lespedeza gives excellent results on the Hayesville and Hiwassee soils. All these crops are of prime importance to those farms on which dairy or beef cattle are produced. Although only a few farms have sufficient acreage of any of these soils to carry out such a long rotation, where consistent with good management at least a small patch of alfalfa should be grown.

Where alfalfa is to be established, approximately 2 tons of ground limestone per acre is required before seeding and a similar quantity every 5 or 6 years. Phosphate and potash should be added as needed. Boron deficiency is common but can be corrected by light annual applications of borax to the areas growing alfalfa.

Moderately heavy farming implements and good draft animals are required in breaking the land or turning under a sod. Fields should be prepared as early in spring as conditions permit. Because of the somewhat restricted range of moisture conditions favorable for tillage, plowing should be avoided when the soils are extremely wet or dry. Maintaining a high content of organic matter favors good

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tilth as well as the fertility and moisture-holding capacity of the soil.

These soils are subject to rather severe losses of water and soil material when row crops are grown frequently, and particularly where tillage is not along the contour. Water control is therefore of primary importance. Such losses from the larger fields may be effectively controlled by the use of suitable rotations in a system of contour strip cropping in which bands of close-growing crops, alternating with row crops, serve as barriers to rapid runoff. Engineering measures include the laying out of crop rows along the contour and possibly the construction of terraces. Permanent guide rows on the contour should be established in fields that are not terraced.

Better management for the production of permanent pasture requires mixed grass and legume pasture plants, applications of 1 and 2 tons of ground limestone every 6 to 8 years, the equivalent of 400 to 500 pounds of 18-percent superphosphate about every 3 years, and in many instances potash. Nitrogen may be needed in getting the pasture plants established.

MANAGEMENT GROUP 2–B

The four soils making up management group 2–B have slopes of 2 to 15 percent and are sufficiently stony to interfere materially with tillage operations. They have a light-brown to dark-brown friable surface soil of medium texture and a yellowish-brown friable clay loam subsoil. The soils are readily permeable, and water, air, and roots easily penetrate both the surface and the subsoil. All are strongly acid, moderately deficient in most of the important plant nutrients, medium to low in organic-matter content, and very responsive to management practices.

Corn, hay, and grass for pasture are the principal crops. Systematic rotations are not generally practiced; usually one row crop follows another, and often the same row crop will be grown on a field year after year. Some farmers alternate crops to a certain extent or even follow potatoes with rye or wheat and then lespedeza or clover for 1 or 2 years. Other rotations used are (1) tobacco followed by rye and lespedeza or clover and then corn, and occasionally (2) corn, crimson clover, and corn.

Cornland is generally fertilized with about 200 pounds of 0–18–0, and manure is added when available. Vegetable crops receive 500 to 800 pounds of a 6–8–6 or 4–12–4 mixture. No special tillage practices are followed. Usually the land is broken in spring for row crops, the rows being laid out the most convenient way across the field.

The soils of this group are well suited to grazing and to corn and can be used intensively, although their stoniness is a handicap. In communities where the proportionate acreage of First-class soils is small, the soils of this group should be cleared of the larger stones if possible and used for row crops. Many areas of steeper soils could thereby be released for use as pasture or other sod-forming crops. Besides contour tillage and removal of stones no special practices are necessary. Except for the stones or gravel the soils could be easily plowed and cultivated with light implements, but in the present condition most of the work must be done by hand.

A legume turned under in the rotation is beneficial in maintaining a high productivity. A high level of soil management for permanent pasture requires a mixture of grasses and legumes, application of 1 to 2 tons of limestone at intervals of 6 or 8 years and the equivalent of 400 or 500 pounds of 18-percent superphosphate per acre every 3 years, clipping for weed control, and regulation of grazing. Potash and even nitrogen might be needed under some circumstances.

MANAGEMENT GROUP 2–C

The three imperfectly to well-drained soils in management group 2–C occupy flood plains along the streams and are overflowed periodically. The fresh sediments usually tend to keep the soil fertility renewed, and in general the soils are moderately fertile. The soils have medium texture and are open and permeable, allowing water, air, and roots to penetrate freely. The surface layer has a considerable range in color and organic matter. Although one of the types is gravelly, none of these strongly to very strongly acid soils is sufficiently stony to interfere materially with tillage. Relief is nearly level and there is essentially no problem of runoff control.

The most common rotations followed are (1) corn, crimson clover, and corn and (2) corn, rye or other small grain, and corn. Corn is grown on many fields for several successive years with no intervening crop. Some fields lie idle for 1 or 2 years, especially following a very wet year when yields were discouraging.

Only small quantities of amendments are added for most crops. Generally about 200 to 300 pounds of 18-percent superphosphate is applied for corn or rye. Some farmers treat the land every 3 to 5 years with between 1,000 and 3,000 pounds of ground limestone per acre. Although manure would be beneficial to these soils, most of it is usually applied to other soils. No rigid system of tillage practices is common, and light farming implements and work animals are sufficient. The land is usually broken late in winter or early in spring.

These soils are excellent for corn, and the well-drained members produce good truck crops. The moderately well-drained soils are better suited to grass and clover meadow. Except on Congaree gravelly fine sandy loam, which is adequately drained, the soils should be drained with open or covered ditches for best yields of some crops. The ditches in areas of Toxaway soil or of the Congaree-Toxaway silt loams may be boxed or tiled. Drains are made of boards, split logs, stones, or a combination of these, although a few farmers use tile effectively. Some of the stream channels have been deepened by dredging or ditching, thus lowering the water table and further aiding drainage.

Rotations that are giving excellent results on these soils in nearby counties are (1) corn followed by grass and clover meadow for 3 or 4 years on the general farm on which labor is scarce and (2) a truck crop of green beans, cabbage, peppers, or potatoes, followed by rye, corn, and meadow on farms where labor is adequate. Such rotations should also be suitable for these soils in Haywood County.

Better management of permanent pastures requires applications of 1 to 2 tons of ground limestone at intervals of 5 to 7 years and 400 to 500 pounds of 18-percent superphosphate, or its equivalent, per acre about every 3 years, and potash when needed. A mixture of grass and legume pasture plants is desirable, and weeds should be controlled by

clipping. Although a system of management approximating this is usually very profitable, these soils will produce good pasture under a lower level of management.

THIRD-CLASS SOILS

Third-class soils are poor to fair for cropland and fair to very good for pasture, but they are limited in physical suitability for the commonly grown crops. The chief limiting factors are hilly relief, erosion hazard, poor internal drainage, or adverse texture, structure, and consistence.

Third-class soils are listed by management groups, and the estimated percentage of each soil in crops, idle cropland, open pasture, and forest in 1946 is given in table 6. Recommended rotations and soil amendments are given in tables 9 and 10.

TABLE 6.—*Estimated percentage of each Third-class soil in crops, idle cropland, open pasture, and forest in Haywood County, N. C., in 1946, by management groups*

Management group and soil	Crops	Idle cropland	Open pasture	Forest
	Percent	*Percent*	*Percent*	*Percent*
GROUP 3–A:				
Clifton clay loam, eroded hilly phase	40	5	55	------
Halewood clay loam, severely eroded rolling phase	20	5	75	------
Hayesville loam, hilly phase	5	5	15	75
Hayesville clay loam:				
Eroded hilly phase	20	5	75	------
Severely eroded rolling phase	20	5	75	------
Hiwassee clay loam, eroded hilly phase	40	5	55	------
Masada clay loam, eroded hilly phase	40	5	55	------
GROUP 3–B:				
Tate silt loam, hilly phase	10	5	10	75
Tusquitee loam, hilly phase	10	5	10	75
Ashe loam, hilly phase	10	5	10	75
Balfour loam:				
Hilly phase	------	------	------	100
Eroded hilly phase	60	5	35	------
Halewood loam:				
Hilly phase	5	5	10	80
Eroded hilly phase	45	5	50	------
GROUP 3–C:				
Buncombe loamy fine sand	45	5	50	------
Warne silt loam	70	5	25	------

MANAGEMENT GROUP 3–A

The seven soils in management group 3–A are rolling to hilly, and runoff is difficult to control under tillage. All these soils are practically stone-free and all but one are eroded. Although the subsoil of each is a firm clay to clay loam, it is moderately friable and sufficiently permeable for satisfactory penetration of water, air, and roots. The plow layer has rather poor tillage properties, especially in severely eroded areas. These soils are low in organic matter, strongly acid, and definitely deficient in phosphorus, potassium, and nitrogen, but are very responsive to management practices.

The soils are commonly used for such general crops as corn, small grain, lespedeza, clover, and grass. Little recognition is given to their suitability for any special crops. The physical properties of the soils, including their relatively high content of clay, favorable depth, and comparatively good water-holding capacity, render them especially desirable for alfalfa, clover, and wheat. The aid provided by these crops in conserving soil material and water is important in an adequate soil management program.

The most common amendment is 200 to 300 pounds of 18-percent phosphate or 100 to 200 pounds of complete fertilizer, which is used for corn and small grains. On many farms corn is side-dressed with 10 to 15 pounds of nitrogen per acre. Manure is applied to the galled spots in the fields and in places to cornland in general. Little lime is used.

No special system of tillage practices is consistently followed. Generally these soils are plowed late in winter or early in spring. Crop rows are usually laid out roughly on the contour, this practice varying considerably in some places. On some farms hillside ditches of sharp incline are run across the fields. These often form gullies that are difficult to control. The range in moisture conditions most desirable for tillage is rather narrow, especially on the redder soils, which if plowed when too wet tend to puddle, bake, and form hard clods, or when too dry, to break in large hard chunks so that tillage is very difficult with the light work animals and implements commonly used.

In most places no systematic rotation is used, but a number of farmers alternate crops. When rotations are followed they are usually corn, small grain, and then hay for 1 to several years, lespedeza being one of the more common hay crops. Suitable and recommended rotations are (1) corn or truck crops, small grain, and clover and grass meadow and (2) corn, small grain, lespedeza, and 3 or 4 years of alfalfa.

Unless precautions are taken, the control of erosion soon becomes a major problem in management. When more organic matter is added through rotations including legumes, the soils become more retentive of moisture. Row crops should not be planted more than 1 year in every 5. It may be preferable to substitute barley for corn if at all feasible. To the extent practicable, corn should be restricted to soils of the first bottoms and other smooth areas.

Upland broken in spring is probably more desirable for corn than that broken in fall, unless it is left in a rough condition throughout the winter. When necessary to practice short rotations, strip cropping with contour bands of sod alternating with the tilled areas should be effective if followed closely.

Management of these soils on a high level for the production of permanent pasture will require a good mixture of grasses and legumes, applications of 1 to 2 tons of ground limestone every 5 or 6 years, applications of 400 to 500 pounds of 18-percent superphosphate per acre, or its equivalent, at intervals of about 3 years, and, in places, potash. Manure or nitrogen may be needed in getting the pasture plants well established, especially on the more eroded areas.

MANAGEMENT GROUP 3–B

The seven hilly soils making up management group 3–B have slopes ranging from 15 to 30 percent, and a high level of management is

necessary to maintain production under tillage. All these soils are virtually stone-free and have been affected little if any by accelerated erosion. The surface soil is a light-brown to brown friable loam or silt loam with good tillage properties. The subsoil is a brownish-yellow to reddish-brown friable clay loam that favors moderate movement of air and moisture. All the soils are moderate to low in organic matter, strongly acid, moderately low to medium in fertility, and responsive to good management practices.

A considerable part of these soils remains in woodland, especially in Pisgah National Forest and Great Smoky Mountains National Park. The few cleared areas are generally used for corn, beans, potatoes, cabbage, small grain, and clover and grass for grazing or for hay. Except for slope, the soils are very well suited to these crops. No systematic rotation is used in general, although crops are sometimes alternated and the soils are kept in sod a considerable part of the time on most farms.

Applications of 200 to 300 pounds an acre of 18-percent superphosphate or 100 to 200 pounds of a complete fertilizer are common. On a few farms corn and wheat are side-dressed with 10 to 15 pounds of nitrogen per acre. Manure is generally applied to the galled spots and in places to cornland. Not much lime is used. No specific system of tillage practices is employed; generally the land is plowed late in winter or early in spring for corn, and only slight preparation is made for small grain. Crop rows usually approximate a contour pattern. On a few farms hillside ditches are run at a sharp incline, and many of these have become deep gullies.

Although these soils produce vegetables well, they are too hilly for such use except in long rotations with grasses and legumes. When it is necessary to run short rotations on fields, the land should be handled under some form of strip cropping, preferably with two-thirds of the area in sod crops and the tilled areas restricted to narrow intervening contour bands where practicable. Grass and clover for hay or grazing are the ideal crops for control of runoff and soil losses. Apples are successfully produced on these soils in a few places in this and in adjoining counties. Where conditions are favorable, orchards established on soils of this group should do well.

In order to conserve soil and water, these soils should be kept under close-growing crops such as legumes and grasses as much of the time as is consistent with good farm management and on some farms should be used for permanent pasture. Better management for pasture production requires liberal applications of phosphorus and ground limestone. In places potash will be needed, and in others, especially severely eroded areas, manure or nitrogen would be effective in establishing the pasture plants. A mixture of bluegrass, orchard grass, Ladino clover, white clover, and common and Korean lespedeza is suitable for these soils. If good results are to be had from this soil management, grazing must be regulated carefully and weeds must be controlled by clipping.

MANAGEMENT GROUP 3–C

The two soils, Buncombe loamy fine sand and Warne silt loam, although different, are placed in one group—management group 3–C—instead of two because of their small acreage. Both soils, however, are low in organic matter, strongly acid, low in fertility, and have

slopes of less than 2 percent. These soils have practically no runoff problem, and they can be used intensively if liberal quantities of manure, fertilizer, lime, and organic matter are applied. They are responsive to good management practices.

No specific rotation system is generally used. Corn is the major crop grown on both soils. Truck crops, particularly beans and potatoes, are grown on the Buncombe soil to some extent, and meadow or pasture ranks second to corn on the Warne soil.

One practice for improving Buncombe loamy fine sand is to seed it, before harvesting the row crops, to grasses and legumes for a winter cover and for grazing. The trampling by livestock throughout the winter tends to keep the soil in a firmer condition. The growth remaining early in spring may be turned under to improve the soil. The soil should be packed following plowing with a roller or cultipacker to improve the seedbed. Manure is helpful in the retention of moisture. Because of leaching, large quantities of fertilizer divided into three approximately equal applications during the growing season are usually necessary to obtain good yields of corn and truck crops. The quantity of phosphate needed is less than that of nitrogen and potash.

The imperfectly drained Warne soil requires the removal of surface water for some crops. Open ditches may be used, but better results are generally had by ridging the crop rows. This soil should not be grazed in winter and early in spring. If left fallow it will not be trampled much by livestock, provided they have access to areas of good grazing on such soils as Buncombe loamy fine sand. Heavy fertilization is not so essential on the Warne as on the associated Buncombe soil.

On some farms it is convenient and even advisable to use these soils for permanent pasture. The best management for pasture includes liberal use of ground limestone, phosphates, and potash in many places, especially on Buncombe loamy fine sand. Nitrogen is effective in establishing a good cover of mixed grasses and legumes, especially on the Buncombe soil. Trampling by livestock will cause little if any injury to the Buncombe soil even when it is wet, but is injurious to the Warne soil. Weeds should be kept under control by clipping, and overgrazing as well as undergrazing should be avoided as far as practicable.

FOURTH-CLASS SOILS

Because of unfavorable physical characteristics Fourth-class soils are poorly suited to crops that require tillage but are moderately productive of pasture plants. Each soil of the group is so difficult to work or to conserve, or both, that cultivation is not generally feasible. On the other hand, each is sufficiently fertile and has adequate moisture to maintain a moderately good to very good cover of pasture plants. Although these soils are only poor to fair for general agriculture, a considerable total acreage is tilled. This use cannot well be avoided in the present agricultural economy, because there are only small areas of First-, Second-, or Third-class soils on many of the farms in the county. On farms where adequate areas of fair to good cropland are available most areas of the Fourth-class soils are used for pasture or forest.

Fourth-class soils are listed by management groups, and the estimated percentages of each soil in crops, idle cropland, open pasture,

and forest in 1946 are given in table 7. Recommended rotations and soil amendments are given for these soils in tables 9 and 10 if they must be used for crops.

TABLE 7.—*Estimated percentage of each Fourth-class soil in crops, idle cropland, open pasture, and forest in Haywood County, N. C., in 1946, by management groups*

Management group and soil	Crops	Idle cropland	Open pasture	Forest
	Percent	*Percent*	*Percent*	*Percent*
GROUP 4–A:				
Ashe loam, steep phase	------	------	------	100
Burton stony loam	------	------	------	100
Halewood loam, steep phase	------	------	------	100
Halewood stony loam:				
Hilly phase	------	------	------	100
Steep phase	------	------	------	100
Hayesville loam, steep phase	------	------	------	100
Porters loam, steep phase	------	------	------	100
Porters stony loam, hilly phase	------	------	------	100
Tate stony silt loam, hilly phase	------	------	------	100
Tusquitee stony loam, hilly phase	------	------	------	100
GROUP 4–B:				
Ashe loam, eroded steep phase	25	5	70	------
Ashe stony loam, eroded hilly phase	20	5	75	------
Clifton clay loam, eroded steep phase	20	5	75	------
Halewood loam, eroded steep phase	25	5	70	------
Halewood clay loam, severely eroded hilly phase	20	5	75	------
Halewood stony loam, eroded hilly phase	------	5	95	------
Hayesville clay loam:				
Eroded steep phase	15	5	80	------
Severely eroded hilly phase	15	5	80	------
Porters loam, eroded steep phase	35	5	60	------
Porters stony loam, eroded hilly phase	50	5	45	------
Stony colluvium (Tusquitee soil material)	------	------	50	50
Tusquitee stony loam, eroded hilly phase	30	10	60	------
Wehadkee fine sandy loam	------	------	100	------

MANAGEMENT GROUP 4–A

The well to somewhat excessively drained soils that make up management group 4–A are either stony, steep, or hilly. Practically all the slopes fall within the range of 20 to 60 percent. Hilly and steep soils of the Ashe, Burton, Halewood, Hayesville, Porters, Tate, and Tusquitee series are included. With the exception of the Burton soil, the surface soils of members of this group consist of friable to mellow loam or stony loam that ranges from light to dark brown. The Burton soil is almost black to a depth of about 18 inches and is extremely high in organic matter. The organic matter of the other nine soils of the group ranges from moderately low to moderately high. The subsoils of all members of the group are moderately friable and permeable to very friable. Water, air, and roots freely penetrate all soils of the group, although the Halewood and Hayesville soils are not so permeable as other members. All these soils are moderately to strongly acid and deficient in most of the important plant

nutrients. They are uneroded, and the 2-inch surface layer is high in organic matter and moderately well supplied with nitrogen.

The soils of this group are almost entirely in forest. Chiefly because of steep slopes, stoniness, or both, they would not be suitable for crops requiring tillage even if accessible and cleared for such use. Where they are accessible and are needed for pasture, however, they could be cleared and used for this purpose with fair to very good results under good management.

Since the soils are in general strongly acid and low in minerals, a high level of management for pasture production requires liberal applications of lime, phosphate, and, in many places, potash. If legumes take a prominent place in the mixture of pasture plants, probably little if any commercial nitrogen will be required for at least a few years following clearing of the land. Applications of 1 to 2 tons of ground limestone at intervals of 6 to 8 years and the equivalent of 400 to 500 pounds of 18-percent superphosphate at intervals of about 3 or 4 years would give good results on most areas, providing other soil and pasture practices conform to a high level of management. Needs for potash probably vary widely among the different soils and from place to place with the same soil. The pasture plants should be watched for potash deficiency symptoms. The best soil and pasture management requires careful consideration of potash needs, suitable mixtures of legumes and grasses, well-regulated grazing, and the control of weeds.

Although these soils are not suited to row crops that require tillage, the soil pattern and other conditions on some farms make this use necessary. Where such crops are grown a very high level of management is needed to maintain the soils and control runoff. If soil productivity is to be maintained, it will be necessary to keep a good vegetative growth on the soils as much of the time as practicable. Ordinarily this will call for long rotations in which grasses and legumes take prominent places. If consistent with good farm management, row crops should not be grown at intervals of less than 5 or 6 years, and strip cropping should be considered where the lay of the land and field and ownership patterns are favorable. Proper strip cropping might provide for somewhat shorter rotations in which row crops are grown at intervals as short as 4 or 5 years. Along with carefully planned rotations and perhaps strip cropping, adequate uses of lime and other amendments and carefully planned tillage practices are necessary for the conservation of the soil and water resources where a rotation including row crops is practiced.

MANAGEMENT GROUP 4-B

Of the 13 soils in management group 4–B, 1 soil is extremely stony, 1 poorly drained, and 11 are eroded hilly stony soils, severely eroded hilly soils, or eroded steep soils, which are very difficult to conserve unless a dense vegetative cover is maintained. None is suitable for crops requiring tillage but all are fair to very good for pasture. The soils range from moderately friable and permeable to very friable and permeable, and water, air, and roots penetrate the subsoil readily. All are acid, moderately fertile, and very difficult to work. The organic-matter content varies from moderate to very low, but all the soils respond readily to good management, especially to lime and phosphate.

Stony colluvium (Tusquitee soil material) and Wehadkee fine sandy loam do not conform well to the other soils of the group and are not very similar to each other. Since they are of small acreages and, like the other soils of the group, fairly well suited to pasture production but definitely unsuitable for tillage, they are placed in this group.

With the exception of the stony colluvium, almost the entire acreage of this group has been cleared and used at one time for crop or pasture production, and most of the soils have been cropped. Some are now being used for crops and have become more or less depleted and eroded, but by far the greater part of these soils is now in permanent pasture and is fairly well to very well suited to such use.

Since the soils of this group are strongly to very strongly acid and more or less deficient in many of the plant nutrients as phosphorus, nitrogen, and in places potassium, the production of good pasture requires good management. Where necessary a suitable mixture of grasses and legumes should be seeded. Bluegrass, orchard grass, Ladino and white clover, and Korean lespedeza usually make a good combination. A well-prepared seedbed also is important. Applications of 1 to 2 tons of ground limestone at intervals of about 6 to 8 years and applications of the equivalent of 400 to 500 pounds of 18-percent superphosphate at intervals of about 3 years are generally sufficient even for a relatively high level of management. It is likely that potash is needed on many soils, and on most of the eroded and severely eroded hilly and steep soils applications of manure or some form of nitrogen will be very effective in establishing the young pasture plants. Clipping to control weeds and carefully regulated grazing are also requirements of a high level of soil and pasture management.

Although the soils of this group are not suitable for row crops, conditions on some farms require their use for this purpose. Where such crops are grown, the control and use of water require close attention. In order to conserve soil and water, it is necessary to maintain a heavy vegetative growth as much of the time as practicable. Ordinarily this will call for long rotations in which grasses and legumes are prominent. If consistent with good farm management, row crops should not be grown at intervals of less than 6 or 7 years on the hilly and steep soils. Where row crops must be grown on such soils, thorough consideration should be given strip cropping in fields where the lay of the land is suitable. Along with carefully planned rotations and perhaps strip cropping, adequate uses of lime and other amendments and carefully planned tillage practices are necessary for the conservation of the soil and water resources when a rotation including row crops is practiced.

Stony colluvium (Tusquitee soil material) could be used for crops requiring tillage if most of the stones were removed, but the expense would probably be too great on most farms. Wehadkee fine sandy loam would also be suitable for most row crops, even in a short rotation, if it were drained and properly limed and fertilized. Drainage would be fairly easy on certain areas, but on most it would be difficult and expensive. Whether this soil should be drained must be determined on each farm where it occurs.

FIFTH-CLASS SOILS

Because of adverse physical characteristics Fifth-class soils are poorly suited to cultivated crops or to pasture under almost any cir-

cumstances. The use suitability of these soils is limited chiefly by steep slopes, stoniness, shallowness, poor moisture conditions, low fertility, or some combination of these. Under such conditions tillage is impractical or even impossible and pasture is generally not feasible. Lack of enough better land on some farms, however, may require the use of some Fifth-class soils for pasture or crops, but conservation, workability, or both, are difficult on these soils, and yields are generally low. Hand implements must be used in most places for preparing the seedbed and for cultivation. Although trees grow more slowly on many of these soils than on those of the other classes, the Fifth-class soils are much better suited to forest than to crops or to pasture.

Fifth-class soils are listed and the estimated percentage of each soil in crops, idle cropland, open pasture, and forest in 1946 are given in table 8.

TABLE 8.—*Estimated percentage of each Fifth-class soil in crops, idle cropland, open pasture, and forest in Haywood County, N. C., in 1946, by management groups*

Management group and soil	Crops	Idle cropland	Open pasture	Forest
GROUP 5:	*Percent*	*Percent*	*Percent*	*Percent*
Ashe stony loam:				
Steep phase				100
Very steep phase				100
Halewood clay loam, severely eroded steep phase	10	5	85	
Halewood stony clay loam, severely eroded steep phase	5	10	85	
Halewood stony loam, eroded steep phase	10	5	85	
Hayesville clay loam, severely eroded steep phase	10	10	80	
Made land				
Porters loam:				
Severely eroded steep phase		20	80	
Very steep phase				100
Porters stony loam:				
Steep phase				100
Eroded steep phase	20	5	75	
Very steep phase				100
Ramsey loam:				
Steep phase				100
Eroded steep phase	20	5	75	
Hilly phase				100
Eroded hilly phase	20	5	75	
Severely eroded steep phase	10	5	85	
Very steep phase				100
Ramsey stony loam:				
Steep phase				100
Eroded steep phase	15	5	80	
Hilly phase				100
Eroded hilly phase	20	5	75	
Very steep phase				100
Rough gullied land (Halewood and Hayesville soil materials)		50	50	
Stony rough land (Porters and Ramsey soil materials)				100

MANAGEMENT GROUP 5

Fifth-class soils are used mainly for forest, since they are not suitable for crops requiring tillage and are poorly to very poorly suited to pasture. Most of their acreage therefore will remain in forest, and much of the Fifth-class land now cleared will revert to woodland and remain in this use for a long time. At present little can be said about soil-management practices for forest, particularly from the farmers' point of view. For this reason the Fifth-class soils have not been subdivided into groups according to soil-management requirements and responses.

Small areas of Fifth-class soils are used for pasture and crops. Such areas are chiefly the eroded steep phases of the Porters, Halewood, and Hayesville soils and the eroded hilly and steep phases of the Ramsey soils. The fertility and required treatments of the Hayesville and Halewood soils are probably somewhat different from those of the Ashe and Porters soils, but further experience and investigations are need to verify this. Even the better Fifth-class soils have slopes of 30 to 60 percent, are eroded in many places, and are low to moderate in fertility. It is very expensive if not impracticable to maintain satisfactory yields of crops requiring tillage on these soils, and pasture management is very difficult.

Where the production of tilled crops is attempted, adequate liming and fertilizing and every reasonable supporting practice for water control are necessary. The use of amendments and careful selection and rotation of crops are especially needed to encourage heavy vegetation. Strip cropping is usually required if productivity is to be maintained any considerable length of time.

For maintenance of pastures, additions of lime and fertilizers, particularly phosphate, and other good management practices are required. In general, legumes should make up a considerable part of the pasture sod, and it is a good practice to apply 1 to 1½ tons of ground limestone and 75 to 100 pounds of triple superphosphate every 4 to 6 years. Because of steep slopes and inaccessibility of these soils, it is usually difficult to apply these materials and to control weeds.

Rough gullied land (Halewood and Hayesville soil materials) requires special attention for reestablishment of vegetation. To the extent feasible, ditches, terraces, or other means of diverting water from these guillied areas should be employed. Following this diversion it is advisable to mulch the areas and to sow mixtures of lespedeza and suitable grasses. Kudzu might be used, or such suitable tree seedlings as shortleaf and white pines might follow the sod to provide a more permanent cover. The less sloping phases of this land type can be prepared gradually for pasture use.

CROP ADAPTATIONS, ROTATIONS, AND WATER CONTROL MEASURES

Suitable crops, rotations, and supplementary water control measures by management groups of the soils are given in table 9.

TABLE 9.—*Suitable crops, rotations, and supplementary water control measures by Haywood County, N. C.*

Management group and soil	Suitable crops	Rotations	Supplem water c meas
GROUP 1–A:			
Balfour loam, rolling phase Tusquitee loam: Rolling phase Undulating phase Tate silt loam, rolling phase State loam: Undulating phase Rolling phase	Corn, small grain, truck, tobacco, and hay.	1. Tobacco, corn, grass 2. Cabbage or potatoes, small grain, hay. 3. Green beans, small grain, hay 4. Corn, crimson clover 5. Corn, small grain, hay 6. Corn, crimson clover, alfalfa for 4 years. 7. Tobacco, small grain, grass-legume pasture.	Contour
GROUP 1–B:			
Masada loam: Undulating phase Rolling phase Altavista silt loam Altavista fine sandy loam	Small grain, corn, truck, hay, alfalfa, tobacco.	1. Tobacco, corn, grass 3. Green beans, small grain, hay 4. Corn, crimson clover 5. Corn, small grain, hay 6. Corn, crimson clover, alfalfa for 4 years. 7. Tobacco, small grain, grass-legume pasture.	do
GROUP 1–C:			
Congaree fine sandy loam Congaree silt loam	Corn, small grain, truck, and hay	4. Corn, crimson clover 8. Cabbage or potatoes, corn (crimson clover). 9. Green beans, corn (crimson clover).	None

TABLE 9.—*Suitable crops, rotations, and supplementary water control measures by Haywood County, N. C.*—Continued

Management group and soil	Suitable crops	Rotations	Supplem water c meas
GROUP 2–A: Halewood loam: Rolling phase Eroded rolling phase Hayesville loam, rolling phase. Hayesville clay loam, eroded rolling phase. Hiwassee clay loam, eroded rolling phase. Masada clay loam, eroded rolling phase.	Small grain, corn, tobacco, grass, clover, alfalfa.	1. Tobacco, corn, grass 2. Cabbage or potatoes, small grain, hay. 3. Green beans, small grain, hay 5. Corn, small grain, hay 6. Corn, crimson clover, alfalfa for 4 years. 7. Tobacco, small grain, grass-legume pasture. 12. Green beans, hay for 2 years. 14. Tobacco, small grain, hay for 2 years.	Contour
GROUP 2–B: Tusquitee stony loam: Rolling phase Eroded rolling phase Tate stony silt loam, rolling phase. State gravelly loam, undulating phase.	Hay, small grain, truck, tobacco, orchards.	1. Tobacco, corn, grass 3. Green beans, small grain, hay 4. Corn, crimson clover 5. Corn, small grain, hay 6. Corn, crimson clover, alfalfa for 4 years. 7. Tobacco, small grain, grass-legume pasture. 10. Orchards and grass hay 12. Green beans, hay for 2 years 14. Tobacco, small grain, hay for 2 years.	do

GROUP 2–C:			
Congaree gravelly fine sandy loam. Toxaway silt loam Congaree-Toxaway silt loams.	Corn, truck, grass	4. Corn, crimson clover 5. Corn, small grain, hay 8. Cabbage or potatoes, corn (crimson clover). 9. Green beans, corn (crimson clover).	Artificia age g i m p these
GROUP 3–A:			
Clifton clay loam, eroded hilly phase. Halewood clay loam, severely eroded rolling phase. Hayesville loam, hilly phase Hayesville clay loam: Eroded hilly phase Severely eroded rolling phase. Hiwassee clay loam, eroded hilly phase. Masada clay loam, eroded hilly phase.	Orchards, alfalfa, clover, small grain, hay, pasture.	6. Corn, crimson clover, alfalfa for 4 years. 10. Orchards and grass hay 11. Corn, small grain, hay for 2 years. 12. Green beans, hay for 2 years 13. Cabbage or potatoes, hay for 2 years. 14. Tobacco, small grain, hay for 2 years. 15. Continuous hay 16. Continuous pasture	Contour strip c
GROUP 3–B:			
Tate silt loam, hilly phase Tusquitee loam, hilly phase Ashe loam, hilly phase Balfour loam: Hilly phase Eroded hilly phase Halewood loam: Hilly phase Eroded hilly phase	Orchards, hay, pasture, small grain, truck.	10. Orchards and grass hay 11. Corn, small grain, hay for 2 years. 12. Green beans, small grain, hay for 2 years. 13. Cabbage or potatoes, small grain, hay for 2 years. 14. Tobacco, small grain, hay for 2 years. 15. Continuous hay 16. Continouus pasture	---do---

TABLE 9.—*Suitable crops, rotations, and supplementary water control measures by Haywood County, N. C.*—Continued

Management group and soil	Suitable crops	Rotations	Supplem water c meas
GROUP 3–C:			
Buncombe loamy fine sand	Corn, small grain, hay, pasture.	3. Green beans, small grain, hay	----------
Warne silt loam		9. Green beans, corn (crimson clover).	----------
		15. Continuous hay	----------
		16. Continuous pasture	----------
GROUP 4–A:			
Ashe loam, steep phase	Pasture and meadow grasses, apple orchards.	10. Orchards and grass hay	Contour strip c if nece till.
Burton stony loam		15. Continuous hay	
Halewood loam, steep phase		16. Continuous pasture	
Halewood stony loam:			
Hilly phase			
Steep phase			
Hayesville loam, steep phase			
Porters loam, steep phase			
Porters stony loam, hilly phase.			
Tate stony silt loam, hilly phase.			
Tusquitee stony loam, hilly phase.			

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GROUP 4–B:			
Ashe loam, eroded steep phase.	Pasture and meadow grasses, apple orchards.	10. Orchards and grass hay	------do
Ashe stony loam, eroded hilly phase.		15. Continuous hay	
Clifton clay loam, eroded steep phase.		16. Continuous pasture	
Halewood loam, eroded steep phase.			
Halewood clay loam, severely eroded hilly phase.			
Halewood stony loam, eroded hilly phase.			
Hayesville clay loam:			
Eroded steep phase			
Severely eroded hilly phase.			
Porters loam, eroded steep phase.			
Porters stony loam, eroded hilly phase.			
Stony colluvium (Tusquitee soil material).			
Tusquitee stony loam, eroded hilly phase.			
Wehadkee fine sandy loam			

TABLE 9.—*Suitable crops, rotations, and supplementary water control measures by*
Haywood County, N. C.—Continued

Management group and soil	Suitable crops	Rotations	Supplem water c meas
GROUP 5:			
Ashe stony loam:			
Steep phase			
Very steep phase			
Halewood clay loam, severely eroded steep phase.			
Halewood stony clay loam, severely eroded steep phase.			
Halewood stony loam, eroded steep phase.			
Hayesville clay loam, severely eroded steep phase.			
Made land			
Porters loam:			
Severely eroded steep phase.			
Very steep phase			
Porters stony loam:			
Steep phase			
Eroded steep phase	Forest		Maintain cover.
Very steep phase			
Ramsey loam:			
Steep phase			

Eroded steep phase			
Hilly phase			
Eroded hilly phase			
Severely eroded steep phase.			
Very steep phase			
Ramsey stony loam:			
Steep phase			
Eroded steep phase			
Hilly phase			
Eroded hilly phase			
Very steep phase			
Rough gullied land (Halewood and Hayesville soil materials).			
Stony rough land (Porters and Ramsey soil materials).			

FERTILIZER REQUIREMENTS

Fertilizers recommended are listed on the basis of nitrogen, phosphoric acid, and potash required in a given rotation within a particular management group. The following general principles should be kept in mind in applying plant nutrients to the rotations.

1. *Nitrogen.* Corn, small grains, and truck crops give best returns from direct applications, and most of that used in the rotation should be applied to these crops.
2. *Phosphoric acid.* The best response is usually obtained by applying this plant food to truck crops, small grains, grasses, and legumes, as clover and alfalfa. Most of the phosphate in the rotation should be used on such crops.
3. *Potash.* Generally promotes the largest returns when used on truck crops, small grains, legumes, and sometimes corn. Its use, however, should generally be spread fairly well over most of the crops in the rotations.
4. *Limestone.* Lespedeza, clover, and alfalfa and other legume crops are usually most responsive to lime, which should be applied prior to seeding the legume, preferably to the crop just preceding it in the rotation. For example, where lespedeza or clover is to be seeded in small grain, the lime should be applied for the rotation when preparing the land for the small grain.

Examples of the application of these principles are given in table 10. Straight phosphate, nitrogen, and potash materials may be used where available, and their use should be taken into account in the application of complete fertilizer on the other crops of the rotation.

TABLE 10.—*Fertilizer requirements per acre by crop rotations*[1] *and management gr*
fertilizer application in Haywood County, N. C.

Rotation, management groups, and crops	Date of planting	Date of fertilizer application	Fertilizer requirement[2]			
			Nitrogen (N)	Phosphoric acid (P_2O_5)	Potash (K_2O)	
ROTATION 1, management groups 1–A, 1–B, 2–A, and 2–B:			*Pounds*	*Pounds*	*Pounds*	
Tobacco (burley)	May 15–30	May 1–15	30	90	90	
Corn	May 1–June 1	May 1–June 1	20	40	80	
		6 to 8 weeks after planting.	60	0	0	
Grass			0	0	0	
ROTATION 2, management groups 1–A and 2–A:						
Cabbage	Mar. 15–May 1	Mar. 15–May 1	60	80	100	
or	June 1–20	3 weeks after setting.	30	0	0	
potatoes	Mar. 20–Apr. 15	Mar. 20–Apr. 15	60	80	100	
Small grain	Sept. 20–Oct. 10	Mar. 15–Apr. 1	30	0	0	
Hay[3]	Mar. 15–Apr. 1		0	0	0	
ROTATION 3, management groups 1–A, 1–B, 2–A, 2–B, and 3–C:						
Green beans	Apr. 1–June 15	At planting	20	60	60	
		At flowering	30	0	0	
Small grain	Sept. 20–Oct. 10	Mar. 20–Apr. 15	30	0	0	
Hay	Mar. 15–Apr. 15		0	0	0	

See footnotes at end of table.

TABLE 10.—*Fertilizer requirements per acre by crop rotations* [1] *and management gro*
fertilizer application in Haywood County, N. C.—Conti

Rotation, management groups, and crops	Date of planting	Date of fertilizer application	Fertilizer requirement [2]			
			Nitrogen (N)	Phosphoric acid (P_2O_5)	Potash (K_2O)	
			Pounds	*Pounds*	*Pounds*	
ROTATION 4, management groups 1–A, 1–B, 1–C, 2–B, and 2–C:						
Corn	May 1–June 1	At planting	20	60	60	Hig
		6 to 8 weeks after planting	40			
Crimson clover	Last corn cultivation.					
ROTATION 5, management groups 1–A, 1–B, 2–A, 2–B, and 2–C:						
Corn	May 1–June 1	At planting	20	60	80	Th
		6 to 8 weeks later	40	0	0	
Small grain	Sept. 20–Oct. 10	Mar. 15–Apr. 15	30	0	0	
Hay	Mar. 15 Apr. 15		0	25	25	
ROTATION 6, management groups 1–A, 1–B, 2–A, 2–B, and 3–A:						
Corn	May 1–June 1	At planting	20	40	80	Plo
		6 to 8 weeks after planting	40	0	0	
Crimson clover	Last corn cultivation.					
Alfalfa	Aug. 1–30	At seeding	20	120	120	
Do			0	0	75	
Do			0	60	60	
Do			0	0	75	

ROTATION 7, management groups 1–A, 1–B, 2–A, and 2–B:						
Tobacco (burley)	May 15–June 10	May 1–25	30	90	90	
Small grain	Sept. 20 Oct. 10	Mar. 15–Apr. 15	30	0	0	
Grass-legume pasture	Aug. 15–Sep. 15 Feb. 15–Mar. 30	Mar. 15–Apr. 15	0	60	60	
ROTATION 8, management groups 1–C and 2–C:						
Cabbage	Mar. 15–May 1	Mar. 15–May 1	60	80	100	
		3 weeks after planting.	30	0	0	
or						
potatoes	Mar. 20–Apr. 15	Mar. 20 Apr. 15	60	80	100	
Corn	May 1–June 1	6 to 8 weeks after planting.	60	0	0	
Crimson clover	Last corn cultivation.					
ROTATION 9, management groups 1 C, 2–C, and 3–C:						
Green beans	Apr. 1–June 15	At planting	20	60	60	
		At flowering	30	0	0	
Corn	May 1–June 1	At planting	20	60		Use
		6 to 8 weeks after planting.	40	0	0	B
Crimson clover	Last corn cultivation.		0	0	0	
ROTATION 10, management groups 2–B, 3–A, 3–B, 4–A, and 4–B:						
Orchards (apple and cherry with grass cover crop).		1 month before buds swell.	(4)			App in

See footnotes at end of table.

TABLE 10.—*Fertilizer requirements per acre by crop rotations* [1] *and management gr*
fertilizer application in Haywood County, N. C.—Cont

Rotation, management groups, and crops	Date of planting	Date of fertilizer application	Fertilizer requirement [2]			
			Nitrogen (N)	Phosphoric acid (P_2O_5)	Potash (K_2O)	
			Pounds	*Pounds*	*Pounds*	
ROTATION 11, management groups 3–A, and 3–B:						
Corn	May 1–June 1	At planting	20	40	80	On
		6 to 8 weeks after planting.	40	0	0	
Small grain	Sept. 20–Oct. 10	Mar. 15 Apr. 1	30	0	0	
Hay (mixed)	Mar. 15–Apr. 15	At planting	0	50	50	
Hay			0	0	0	
ROTATION 12, management groups 2–A, 2–B, 3–A, and 3–B:						
Green beans	Apr. 1–June 15	At planting	20	60	60	
		At flowering	30	0	0	
Small grain	Sept. 20–Oct. 10		0	0	0	
Hay	Mar. 15–Apr. 1	At planting	0	50	25	
Hay			0	0	0	
ROTATION 13, management groups 3–A and 3–B:						
Cabbage	Mar. 15–May 1	At setting	60	80	100	
		3 weeks after setting.	30	0	0	
or potatoes	Mar. 20–Apr. 15	At planting	60	80	100	
Small grain	Sept. 20–Oct. 10	Mar. 15–Apr. 1	30	0	0	
Hay	Mar. 15–Apr. 1	At seeding	0	60	60	
Hay			0	0	0	

ROTATION 14, management groups 2–A, 2–B, 3–A, and 3–B:						
Tobacco	May 15–30	May 1–15	40	80	80	
Small grain	Sept. 20–Oct. 10	Mar. 15–Apr. 1	30	0	0	
Hay	Mar. 15–Apr. 15	At seeding	0	50	50	
Hay			0	0	0	
ROTATION 15, management groups 3–A, 3–B, 3–C, 4–A, and 4–B:						Wh g c b li
Continuous hay	Aug. 1–Sept. 1	At seeding	20	60	30	
		To maintain	0	60	30	
ROTATION 16, management groups 3 A, 3–B, 3–C, 4–A, and 4–B:						
Continuous pasture	do	do	20	60	30	

[1] Other rotations may be used; a rotation should be suited to the farming system, give maximu opportunity to maintain or improve the fertility level.

[2] Manure should be applied first to thin or galled spots especially on upland soils; when applied returns are usually obtained from tobacco, corn, and alfalfa; fertilizer requirements per acre may 6 pounds of phosphoric acid, and 12 pounds of potash for each ton of manure applied. Each soil applications should suit crops grown and type of rotation followed.

[3] All hay in rotation refers to a legume-grass mixture.

[4] 1.6ounces per year of age of tree.

AGRICULTURAL PRACTICES

Practically none of the land has been terraced, and because of the prevailingly steep slopes the general use of terraces is not recommended. Contour tillage is practiced on most steep land, and strip cropping is becoming more common in some localities. Few if any farmers run contours by use of a level, however, but depend merely on the unaided eyesight. Much of the small area of poorly drained land in the county has been drained artificially. Open ditches or covered box-type ditches made of poles and slabs or rocks are used to remove excess water. Cropland is broken in spring, usually in March and April; whenever possible much of the land sloping south is broken in November and December.

On some farms water-conserving and soil-building rotation systems are followed. A rotation used on soils of the bottom lands, stream terraces, and lower colluvial slopes includes potatoes, followed by rye, which is turned in spring and the land planted to corn. The cornland is sown to rye, with lespedeza seeded late in winter in the rye, and cut for hay. The fourth year lespedeza is turned late in fall and the land is again planted to potatoes. Another rotation used on these soils is corn followed by rye, with lespedeza sown in the rye in spring and cut for hay; the second year of lespedeza is turned for corn. A third rotation used is tobacco followed by rye, which is turned for corn. In some localities corn is followed by crimson clover each year, the clover being turned for corn; in others, rye is followed by corn and the corn by rye. In some communities corn is followed by corn year after year without an intervening crop.

Rotations practiced on the Hayesville, Clifton, and Halewood soils include either small grain and lespedeza followed by corn or red clover followed by corn. The following rotations are sometimes used on the Ashe soils: (1) Corn, followed by grass and clover for 2 years, and then potatoes or beans; (2) green beans or potatoes, followed by rye and clover for 2 years, and then by potatoes or beans; (3) corn, followed by rye or grass and clover, and then by potatoes or green beans. Rotations on Porters soils and the strongly rolling and hilly Tusquiteee and Tate soils include corn for 1 or 2 years, followed by grass and clover, used the first year for hay and then for 3 or 4 years, or until it becomes too weedy, for pasture.

In the production of grass and clover the general practice is to cut the crop the first year for hay and then graze it from 2 to 4 years or until the land is again cultivated. Grasses, clover, and rye are seeded in corn late in July or early August, the corn crop being harvested in fall. Lespedeza is generally seeded in small grain late in winter or early in spring.

Commercial fertilizer is used in the production of practically all crops grown. The greater quantity—on the basis of total tonnage used—is applied to subsistence crops and orchards, but the heaviest applications are made on tobacco and truck crops. This estimate of fertilizer used does not include the phosphate fertilizers supplied by the Tennessee Valley Authority chiefly for improvement of sod crops.

The grades of fertilizer most generally used (in 1949) are 6–8–6, 4–8–8, 3–9–6, 0–18–0, and 16–0–0, and the quantities range from 200

to 1,000 pounds an acre. Superphosphate is the principal fertilizer used for corn and small grain, 200 to 400 pounds an acre for corn and 300 to 400 pounds for small grain. A few farmers apply 200 to 300 pounds of 6–8–6, 4–8–8, or 6–6–12 to land for corn and wheat Some phosphate fertilizer, 0–18–0 or its equivalent, is applied to pasture at the rate of about 300 pounds an acre.

Manure is spread at the rate of 5 to 6 tons an acre in spring on eroded places in cornland or in fall on thin areas in small-grain land. In some sections it is applied to land used for truck crops, but very little is used on pasture. The use of lime has gradually increased—some of it is used on truck crops, mostly cabbage and snap beans, some on subsistence crops, and a little on the lower slopes or smoother pasture areas. The usual initial application is 1 to 2 tons an acre, although occasionally bottom-land soils may receive as much as 4 tons.

SOIL PRODUCTIVITY

Crops in Haywood County vary in yield according to the nature of the soils on which they are grown and the management practiced in their production. The estimated average acre yields of the more important crops over a period of years are given for each soil under two levels of management in table 11.

The yield estimates in columns A are those to be expected under the prevailing management practices, although these practices are not the same on all soils or in all parts of the county. Most farmers, however, make some effort to improve their land by adding manure or small quantities of commercial fertilizer or by occasionally changing field boundaries and rotating crops. The yield data are based on specific information on crop yields obtained from individual farmers throughout the county, the agricultural agent, and other farm leaders.

In columns B the crop yields listed represent expectable average acre yields over a period of years under good soil management. These yields are actually obtained by the more progressive farmers. Good soil management involves measures employed to maintain or increase soil productivity within practical limits, as the selection of suitable crops and rotations; the correct use of commercial fertilizer, lime, and manure; the return of organic matter to the soil; proper tillage; and engineering measures for the control of water on the land. The yields in columns B, when compared with those of columns A, give some idea of the response crops are expected to make to good soil management. Yields in columns B may be considered as production goals, which can be reached by feasible management practices.

The same goal may be reached by one or by several different combinations of practices. The proper choice of soil-management practices depends on the farm business as a whole—on one farm it may be practical to manage the soil so that yields exceed that goal; on another it may not be practical to reach the goal. Descriptions of management systems that may be expected to produce average yields given in columns A and B of table 11 will be found in the section on Use, Management, and Productivity of the Soils and in tables 9 and 10, which give rotations, fertilization practices, and water control measures.

TABLE 11.—*Haywood County, N. C., soils: Average acre yields to be expected ov*

[Yields in columns A are those to be expected under common practices of management; those in columns B, under good practices
crop is not commonly grown because of poor adaptation]

Soil	Corn		Wheat		Lespedeza hay		Clover and grass hay		Potatoes		Tobacco (burley)		Green beans [1]	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Bu.*	*Bu*
Altavista fine sandy loam	35	70	14	22	0.9	1.6	1.2	2.0	140	200	1,500	1,800	130	18
Altavista silt loam	35	70	14	22	1.0	1.7	1.3	2.1	130	190	1,500	1,800	130	18
Ashe loam:														
Eroded steep phase	10	22	7	----	.4	.8	.5	1.0	----	----	----	----	----	----
Hilly phase	16	32	9	17	.6	1.1	.7	1.3	65	115	800	1,000	100	13
Steep phase	12	26	8	----	.5	.8	.6	1.1	----	----	----	----	----	----
Ashe stony loam:														
Eroded hilly phase	14	28	----	----	.4	.9	.5	1.1	55	105	----	----	----	----
Steep phase	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Very steep phase	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Balfour loam:														
Eroded hilly phase	20	43	10	18	.5	1.2	.8	1.5	70	120	900	1,100	105	13
Hilly phase	22	45	11	20	.6	1.3	.9	1.6	75	125	1,000	1,200	110	14
Rolling phase	30	55	14	22	.7	1.5	1.1	1.8	120	180	1,200	1,500	120	16
Buncombe loamy fine sand [6]	15	30	5	10	.6	.8	.7	.9	70	120	----	----	80	11
Burton stony loam	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Clifton clay loam:														
Eroded hilly phase	20	43	11	20	.7	1.3	.9	1.7	75	110	1,100	1,400	100	13
Eroded steep phase	----	30	----	----	.5	1.1	.7	1.6	----	----	----	----	----	----
Congaree fine sandy loam [6]	38	65	10	18	1.2	1.6	1.4	2.0	120	200	1,400	1,800	130	18
Congaree gravelly fine sandy loam [6]	35	60	10	18	1.1	1.5	1.3	1.9	115	190	1,300	1,700	120	17
Congaree silt loam [6]	40	75	12	20	1.3	1.8	1.5	2.2	140	220	1,500	1,900	140	19
Congaree-Toxaway silt loams [6 7]	30	75	----	18	1.0	1.9	----	2.2	----	220	----	----	----	19
Halewood clay loam:														
Severely eroded hilly phase	----	----	----	----	----	.8	----	1.0	----	----	----	----	----	----
Severely eroded rolling phase	----	35	6	15	.3	1.0	----	1.2	----	----	----	----	----	----
Severely eroded steep phase	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Halewood loam:														
Eroded hilly phase	18	37	10	18	.6	1.4	.9	1.7	60	110	900	1,100	100	13
Eroded rolling phase	22	45	10	18	.6	1.4	1.0	1.7	90	155	1,000	1,300	110	15
Eroded steep phase	----	22	----	----	.3	.9	.4	1.4	----	----	----	----	----	----
Hilly phase	20	40	10	18	.6	1.4	1.0	1.7	65	115	1,000	1,200	105	14
Rolling phase	27	50	12	20	.7	1.5	1.0	1.8	105	170	1,100	1,400	115	15
Steep phase	----	25	----	----	.4	.9	.5	1.4	----	----	----	----	----	----
Halewood stony clay loam, severely eroded steep phase.	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Halewood stony loam:														
Eroded hilly phase	15	35	8	16	.4	1.0	.7	1.4	55	95	800	1,000	95	1
Eroded steep phase														
Hilly phase	18	37	10	18	.5	1.1	.8	1.5	60	100	900	1,100	100	1
Steep phase														
Hayesville clay loam:														
Eroded hilly phase	15	35	8	14	.4	1.1	.7	1.4	60	100	900	1,100		1
Eroded rolling phase	18	40	9	16	.5	1.3	.8	1.6	80	135	1,000	1,300	100	1
Eroded steep phase		23			.3	.7	.4	1.2						
Severely eroded hilly phase						.8		1.0						
Severely eroded rolling phase		30	6	12	.3	1.0		1.2						
Severely eroded steep phase														
Hayesville loam:														
Hilly phase	17	37	9	16	.5	1.3	.8	1.5	80	140	1,000	1,200	100	1
Rolling phase	23	45	11	18	.6	1.4	.9	1.7	90	150	1,100	1,400	105	1
Steep phase		23			.3	.8	.4	1.3						
Hiwassee clay loam:														
Eroded hilly phase	20	43	11	20	.7	1.3	.9	1.7	75	110	1,100	1,400	100	1
Eroded rolling phase	25	50	22	32	.9	1.5	1.1	1.9	120	180	1,300	1,600	120	1
Made land														
Masada clay loam:														
Eroded hilly phase	18	37	9	17	.5	1.2	.8	1.6	75	110	1,000	1,300	100	1
Eroded rolling phase	20	45	10	18	.6	1.4	1.0	1.7	105	165	1,100	1,400	105	1
Masada loam:														
Rolling phase	25	50	13	20	.7	1.5	1.1	1.8	110	170	1,200	1,500	110	1
Undulating phase	30	60	14	22	.9	1.6	1.2	1.9	120	180	1,300	1,600	120	1
Porters loam:														
Eroded steep phase	14	30			.4	1.0	.6	1.3						
Severely eroded steep phase														
Steep phase		30			.5	1.0	.7	1.4						
Very steep phase														
Porters stony loam:														
Eroded hilly phase	16	32	8	16	.5	1.1	.7	1.4	60	110				
Eroded steep phase														
Hilly phase	18	37	10	18	.6	1.2	.8	1.6	70	120				
Steep phase														
Very steep phase														
Ramsey loam:														
Eroded hilly phase														
Eroded steep phase														
Hilly phase														
Severely eroded steep phase														
Steep phase														
Very steep phase														
Ramsey stony loam:														
Eroded hilly phase														
Eroded steep phase														
Hilly phase														
Steep phase														
Very steep phase														
Rough gullied land (Halewood and Hayesville soil materials)														

See footnotes at end of table.

TABLE 11.—*Haywood County, N. C., soils: Average acre yields to be expected over a p*

[Yields in columns A are those to be expected under common practices of management; those in columns B, under good practices
crop is not commonly grown because of poor adaptation]

Soil	Corn		Wheat		Lespedeza hay		Clover and grass hay		Potatoes		Tobacco (burley)		Green beans [1]	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Lb.*	*Lb.*	*Bu.*	*Bu*
State loam:														
Rolling phase	35	70	14	22	1.0	1.7	1.4	2.1	130	200	1,400	1,800	130	18
Undulating phase	40	75	15	25	1.2	1.8	1.5	2.2	140	220	1,600	2,000	140	20
State gravelly loam, undulating phase	35	60	10	18	1.1	1.5	1.3	1.9	115	190	1,300	1,700	120	17
Stony colluvium (Tusquitee soil material).														
Stony rough land (Porters and Ramsey soil materials).														
Tate silt loam:														
Hilly phase	22	50	11	20	.7	1.4	1.0	1.7	85	140	1,100	1,300	115	15
Rolling phase	30	60	14	22	.9	1.6	1.2	2.0	120	190	1,300	1,700	125	17
Tate stony silt loam:														
Hilly phase	20	45			.6	1.2	.9	1.6	80	130	1,000	1,200	105	14
Rolling phase	28	55	12	20	.8	1.5	1.1	1.8	100	175	1,200	1,500	120	16
Toxaway silt loam [6 7]	20	75		16	.6	1.9		2.2		220				19
Tusquitee loam:														
Hilly phase	30	60	12	21	.9	1.5	1.1	1.9	110	180	1,200	1,500	120	16
Rolling phase	35	70	14	23	1.1	1.7	1.4	2.1	130	200	1,400	1,800	130	18
Undulating phase	40	75	15	25	1.2	1.8	1.5	2.2	140	220	1,600	2,000	140	20
Tusquitee stony loam:														
Eroded rolling phase	35	65	12	20	1.1	1.6	1.3	2.0	125	195	1,300	1,700	125	17
Eroded hilly phase	20	40	10	18	.6	1.2	.7	1.4	70	140				
Hilly phase	25	50	11	20	.8	1.4	1.0	1.8	90	160	1,000	1,300	100	15
Rolling phase	30	60	13	22	.9	1.5	1.2	1.9	110	190	1,300	1,700	120	17
Warne silt loam [7]	16	30				1.5		1.9						
Wehadkee fine sandy loam [6]														

[1] Estimates for green beans are for one crop per year; two crops per year are not an uncommon practice.

[2] Workability refers to ease of tillage, harvesting, and other field operations.

[3] Conservability refers to the ease with which productivity and workability can be maintained and includes ease of conservation of soil material and plant nutrients and maintenance of good tilth.

[4] Classification of soils according to relative physical suitability for general agriculture.

[5] Cow-acre-days, used to express the carrying capacity of pasture land, is the product of the number of animal units carried per acre multiplied by the number of days that animals can be grazed without injury to the animal unit per acre for 360 days rates for 180 days of the year rates 90; and a rates 25.

[6] High water causes damage every 3 in arriving at the productivity.

[7] Yields in columns A are obtained drained areas.

[8] Very good when soil is adequately

GENERAL CHARACTERISTICS OF FARMING

Before the white man settled in the area in which Haywood County is located, the Indians carried on a crude agriculture. They planted only small patches of corn and other crops, usually on bottom lands, and depended largely on game and fish for subsistence. The early white settlers farmed somewhat like the Indians—they cleared small tracts, planted only enough crops to supply themselves with food, and depended on livestock, hunting, and Indian trade for other things needed. They farmed until the soils were considerably depleted, then cleared other areas and let the first fields grow up in trees.

Cattle raising soon became a chief part of the agriculture. In later years, when grazing lands became scarce because of the population increase, cash crops replaced cattle to some extent. As roads became available for the transportation of agricultural products to market, large areas were cleared and used for cultivated crops.

Most of the land suitable for agriculture is cleared and in use, but because of steepness and susceptibility to erosion a considerable part of the land is not suited to tilled crops. Corn, wheat, rye, oats, hay, and forage are the principal subsistence crops, and tobacco, cabbage, snap beans, and potatoes the principal cash crops. Considerable livestock is produced, both for beef and for dairy purposes. Practically every farm has garden vegetables and usually sufficient potatoes and sweetpotatoes for home consumption. There are several commercial orchards, and small apple orchards and a few cherry and pear trees are on most farms but peach trees are very scarce. Forest products, timber, and other industries supplement agriculture in the county and help support the present population, which could hardly gain a livelihood from farming under the prevailing management level.

No one crop dominates the agriculture. Truck crops are limited largely to the section near Waynesville. Corn, wheat, and hay are grown in all agricultural sections, but their distribution and proportion are determined by the character of the soil and slope of the land. The central part of the county has smoother relief than other areas and is therefore better suited to nearly all crops. Even though areas in other parts of the county are suitable for farming, they are small and widely separated by rough mountains, and some are within boundaries of a national park or forest. Although the agricultural areas are nearly level to moderately rolling, most of the county is hilly to steep and a large part is covered by high rugged mountains. Generally a close relation is evident between the kind of soils and the crops grown.

The agriculture of the county depends largely on a relatively small acreage of certain soils. Listed in order of relative importance, these are Tusquitee, Congaree, Hayesville, Halewood, Porters, State, Ashe, Hiwassee, Masada, and Altavista soils. The Ashe and Halewood soils produce most of the potatoes; the Congaree, Altavista, and Halewood, the greater part of the green beans. Corn is grown largely on the Congaree, Tusquitee, Halewood, Hayesville, Porters, State, and Altavista soils. The Ashe and Burton soils are limited in the production of crops chiefly because of steep slopes, stoniness, and inaccessibility.

Tilled crops are grown wherever the soils are suitable. The steeper lands are used mostly for pasture and forest but are sometimes culti-

vated in order to control weeds or because of necessity. On farms having both steep and relatively level to moderately rolling soils the general practice is to crop the less steep fields and use the rest of the open areas for pasture and forest. By this system water control and erosion problems are considerably modified. Many farms, however, have only hilly or steep lands that are often used for crops, and runoff is difficult to control (pl. 6, *A*).

The changes that have taken place in the acreage of the principal crops from 1919 to 1945 are shown in table 12.

TABLE 12.—*Acreage of the principal crops and number of fruit trees and grapevines in Haywood County, N. C., in stated years*

Crop	1919	1929	1939	1949
Grain:	*Acres*	*Acres*	*Acres*	*Acres*
Corn	15, 905	10, 526	13, 278	8, 621
Wheat	7, 202	1, 724	1, 526	237
Oats	2, 442	517	252	183
Rye	437	656	495	54
Buckwheat	35	22	9	(1)
Potatoes	644	910	894	382
Tobacco	173	589	945	1, 239
All hay	5, 392	4, 527	3, 792	7, 181
Timothy and clover, alone or mixed	2, 783	2, 783	1, 568	3, 889
Clover alone	652	185	108	(1)
Alfalfa	4	16	22	661
Grains cut green	338	81	328	776
Legumes cut for hay	20	455	369	251
Other hay	1, 595	1, 007	1, 397	1, 604
Sorghum	506	56	(1)	1
Forage crops	4, 012	982	1, 460	1, 264
	Number	*Number*	*Number*	*Number*
Apples, trees	147, 525	116, 176	114, 369	86, 367
Cherries, do	3, 955	5, 628	6, 034	3, 564
Peaches, do	11, 489	8, 402	1, 517	444
Grapevines	4, 641	3, 264	6, 070	4, 813

[1] Data not available.

Corn, the most important crop in acreage, is grown on most of the tillable soils, but yields on much of the acreage are low. This is due largely to the relatively low level of soil fertility and management. Best yields are generally obtained on Tusquitee, Congaree, and State soils because they are relatively high in organic-matter content and normally have a favorable moisture content. Practically all the corn is used for feeding work animals and other livestock; some is ground into meal for domestic use, and any excess is always in local demand. Considerable corn is cut for silage.

Hay is grown on most of the agricultural soils and occupies the second largest total acreage. It is used locally as feed for cattle, chiefly during winter, and for work animals. Most farms produce a sufficient quantity for feed but none for sale.

Tobacco is the third crop in importance from the standpoint of acreage and is the most important cash crop. The acreage of tobacco has been rather erratic since 1879. The first type grown was flue-cured or bright leaf, which apparently was not well suited to the area. Between 1909 and 1919 burley tobacco was introduced and quickly replaced the bright type. Much of the fertilizer used in the county is applied to the tobacco crop, and usual rates are between 400 and 1,500 pounds an acre. The average application is from 600 to 800 pounds of 3–9–6,[9] 3–9–9, or a similar mixture. The crop is marketed in Asheville or nearby towns in Tennessee. The best land on the farm is usually selected for tobacco, and this crop has priority over all others in fertilizer, manure, and labor.

Potatoes are generally grown on the coarser textured soils, the greatest acreage being on Halewood, Porters, Ashe, and the first-bottom soils. Potato fields generally receive heavy applications of 6–8–6 or equivalent fertilizer, the rates running about 600 pounds an acre. Since 1919 the average yield has continuously increased, probably because of the use of better fertilizing materials and disease-resistant and higher yielding strains. The best potatoes are sold on local markets; the others are fed to cattle and hogs or used by the farm family. Next to tobacco, potatoes have priority on fertilizer and labor. Very little manure is used because of potato diseases.

Wheat yields are low chiefly because of inferior seed, poor land preparation, winterkilling, and low fertilization. Areas of the finer textured soils are generally used for wheat. The general practice is either to apply about 200 pounds an acre of superphosphate or sometimes 100 to 200 pounds of complete fertilizer to the land or to grow the grain after crops that have received heavy fertilizer applications.

Rye has varied greatly in importance since 1919. Most of the grain harvested is used locally, being sown to provide a winter cover crop for early spring grazing or to turn into the soil. Very little is sold outside the county. Generally the crop is sown in cornland with very little seedbed preparation and little or no fertilization.

Several other crops are grown, but the total acreage is small and the value not great. Sorghum is grown for feed, being cut and dried for fodder and generally left in the field until used. Sweet sorghum is grown for molasses for home use or local markets. Oats are planted to some extent for grain, but most of the crop is cut green for hay. Barley is largely a hay crop. Sweetpotatoes are grown for home consumption, with only a small quantity for sale on local markets.

Most of the vegetable crops are planted on the bottom-land soils and on the less sloping Porters and Ashe soils. They receive generous applications of fertilizer and are of high quality. Only a small total acreage of vegetables is grown for market. A cannery at Waynesville packs much of the spinach and snap beans, although some beans are marketed in Asheville and occasionally a truckload is taken to Atlanta, Ga.

A few commercial apple orchards are on Tusquitee, Halewood, and Porters soils. The fruit is of excellent quality and is generally taken by truck to outside markets. Orchards are fertilized, sprayed, pruned, and generally kept in very good condition.

[9] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

Permanent and plowable pasture in 1950 occupied a total of 108,254 acres on 2,368 farms. Pastures are on practically all the soils of the county, but are more commonly on Porters, Ashe, Halewood, Hayesville, and Ramsey soils. Pasture mixtures on the Porters and Ashe soils usually include Kentucky bluegrass, orchard grass, and some Ladino and white clover and lespedeza; those on the Halewood, Hayesville, and Ramsey are Korean and common lespedeza, Ladino clover, orchard grass, and redtop, or lespedeza alone. Usual rates of seeding on most lands are about 25 pounds an acre of the mixtures. Generally, grass is fertilized with 200 to 400 pounds of superphosphate or its equivalent once every 3 years. On some of the more accessible pastures 1 to 1½ tons of ground limestone are applied every 4 to 6 years.

Pasture yields are generally good, and the grazing season extends from about April 15 to October 15. Porters soils afford the better upland pasture, followed in order by the Ashe, Halewood, Clifton, and Hayesville soils (pl. 6, *B*). Well-drained soils of the bottom lands and those of low terraces are very desirable for pasture, and the soils of the colluvial lands are excellent, but most of their areas are used for tilled crops and should continue in this use. The carrying capacity of sod on soils of bottom land, terrace, or colluvial areas is generally much higher than that on the upland soils.

Considerable livestock is raised; almost every well-established farm has a few hogs, one to three milk cows, and a small flock of chickens. The hogs are raised chiefly for a home supply of meat and lard, though a few are sold to local markets. Much of the milk and a large quantity of the chickens and eggs are used by the farm families, but some are sold to outside markets. In 1950, 868,611 gallons of whole milk and 2,705 pounds of cream were sold. There were 197,370 dozen eggs sold. A number of farms produce from one to several beef animals each year for sale on local markets or shipment outside. The number of livestock on farms in Haywood County in stated years is given in table 13.

TABLE 13.—*Number of livestock on farms in Haywood County, N. C., in stated years*

Livestock [1]	1930	1940	1950
	Number	*Number*	*Number*
Horses	[2] 1, 725	[2] 2, 221	2, 398
Mules	[2] 748	[2] 601	298
Cattle	[2] 16, 242	[2] 17, 887	22, 923
Hogs	[2] 2, 858	[3] 3, 740	[3] 3, 893
Sheep	[4] 6, 126	[4] 2, 273	2, 457
Goats	[1] 185	[4] 92	[5]
Chickens	[2] 59, 483	72, 465	81, 274
Beehives	2, 650	1, 583	2, 576

[1] All ages unless otherwise indicated by footnote.
[2] Over 3 months old on April 1.
[3] Over 4 months old on April 1.
[4] Over 6 months old on April 1.
[5] Not reported.

In 1950 there were 1,048 farms classified by type as follows: field crop, 418; livestock, 323; general, 155; dairy, 88; fruit and nut, 27; poultry, 22; and vegetable, 15. In that year, 1,736 farms were listed as miscellaneous and unclassified.

In 1950 there were 2,784 farms in the county; they averaged 59.9 acres per farm, of which 38 acres was cropland harvested. The total land in farms was 166,791 acres, or 48 percent of the county. Of this total, 22,845 acres was used for crops; 2,595 was idle or fallow cropland; 6,848, plowable pasture; 66,563, farm woodland; and 67,940, all other land in farms. The number of farms operated by full owners in 1950 was 1,993, by part owners, 392; by managers, 1; and by tenants, 398.

MORPHOLOGY AND GENESIS OF SOILS

Soil is the product of the forces of weathering and soil development acting on the parent material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point depend on (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and has existed since accumulation; (3) the plant and animal life in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of development have acted on the material.

The parent material of the soils of Haywood County may be considered in two broad classes: (1) Material residual from weathering of rocks in place and (2) material transported by water or gravity and laid down as unconsolidated deposits of clay, silt, sand, and rock fragments. The residual material is related directly to the underlying rock from which it was derived; the transported material, to the soil or rock from which it was transported.

The residual parent material consists of weathered products of igneous and metamorphic rocks that differ greatly in chemical and mineralogical composition and physical character. There has not been enough study of the rocks of the county to find out their specific difference in chemical and mineralogical composition and to show how such differences are connected with variations among the soils. The differences among most soils developed from residual products of rock weathered in place are associated with differences among the rocks from which they were derived. Similar rocks underlie dissimilar soils in several places where relief differences occur.

Although some soil characteristics can be correlated with the kind of parent material from which the soils were derived, others—especially those of regional significance to soil genesis—must be attributed to other factors. The climate varies from place to place because of the great range in elevation, and these variations have contributed to differences among the soils.

The valley sections have fairly long but only moderately warm summers, relatively short and mild winters, and medium high rainfall. Relatively mild climate favors rapid chemical reactions under the moist conditions existing in the soil much of the time. The high rainfall promotes leaching of soluble materials, such as bases, completely from the soil and translocation of less soluble materials and colloidal

matter downward. Since the soil is frozen for only short periods and to shallow depths, there is further intensification of weathering and translocation of materials.

Temperatures are much lower in the higher and more mountainous sections than in the valleys, and chemical reactions in the mountainous soils are appreciably slower than in those in the valleys. Although the high rainfall tends to leach and to translocate soluble materials and colloidal matter downward in the soil, the soil is frozen for longer periods and to greater depths than in the valleys, and leaching is retarded correspondingly.

Within any one climatic zone certain outstanding characteristics are common to the well-drained well-developed soils, but the soils differ in other characteristics that may be correlated with factors besides climate. The kinds of parent material have been outstandingly important in causing soil differences. The climate over the larger part of the county has characteristics of that of both the Red-Yellow Podzolic and Gray-Brown Podzolic soil regions; consequently, Red-Yellow and Gray-Brown Podzolic soils are intimately associated, and differences in such factors as parent material, drainage, and age have been important in determining the great soil group to which the soils belong. In general, the climatic conditions of the valleys are those that commonly give rise to soils in the Red-Yellow Podzolic great soil group and those of the mountains to soils of the Gray-Brown Podzolic. All gradations, however, between these two conditions of soil formation are found.

Higher plants, micro-organisms, earthworms, and other forms of life live on the soil and in it and contribute to its morphology. The nature of the changes they bring about depends on, among other things, the kinds of life and the life processes peculiar to each. The types of climate, parent material, relief, other organisms, and the age of the soil are among the many environmental factors that determine the kinds of plants and animals. Climate is a determinant of the kinds of higher plants that grow on the well-developed well-drained soils and thus indirectly exerts a powerful influence on soil morphology. Climate and vegetation together, therefore, are active factors of soil formation.

Haywood County was originally covered by forest consisting principally of deciduous trees, as chestnut, sugar maple, yellow birch, black cherry, cucumbertree, and beech in the mountains, and white ash, yellow-poplar, basswood (linden), Northern red, white, and other oaks, hickory, walnut, and some chestnut in the valleys. At the highest elevations were hemlock, spruce, and some balsam fir. White pine was associated with hardwoods on some of the lower slopes and in the valleys. The undergrowth of the mountain forest included many plants, such as rhododendron, mountain-laurel, huckleberry, and galax, which in many places were absent in the valley forest. These vegetation differences probably were partly the result of climatic differences.

Many of the trees and shrubs are moderately deep feeders, most of them are deciduous, and practically all shed their leaves annually. The content of the various plant nutrients in the leaves varies considerably, but in general the quantities of bases and phosphorus returned to the soil by leaves of deciduous trees are high compared with those

returned by leaves of coniferous trees. In this transfer of materials, essential plant nutrients returned to the upper part of the soil from the lower partly replace those lost through the action of percolating waters. It is probable that the transfer is greater in the soils of the valleys than in those of the mountains and tends to offset, to some extent, the more rapid weathering of rocks and leaching of soils at the lower elevations.

Much organic material is added to the soil by the decay of leaves, twigs, roots, and entire plants, and most of it is in the topmost part, where it is acted on by micro-organisms, earthworms, and other forms of life and by direct chemical reactions. The rate of decomposition is probably more rapid in the valleys than on the mountains, and partly as a result some well-drained soils of the higher mountains contain considerably more organic matter than do well-drained soils of the valleys. The decomposition of organic material releases organic acids that promote the rate of solution of slowly soluble constituents and the rate of leaching and translocation of inorganic materials. The intensity of the effect of the acids is conditioned by climate, which modifies the kinds of vegetation and micro-organisms and the rates of the reactions and leaching.

The relief of the county ranges from almost level to very steep. In some steep areas where the surface runoff is great, geologic erosion is rapid and keeps almost even pace with rock weathering and soil formation. Soil materials are being constantly removed or mixed by creeping, rolling, or slipping in minute to moderate slides, and in most places do not remain stable long enough for a profile of genetically related horizons to form. The quantity of water that percolates through the soil is small, and the amount of leaching and translocation of materials is correspondingly little. On such soils the vegetation is commonly less dense than on soils with more favorable moisture relations. Soils on steep slopes are better developed where the slope is concave than where it is convex. On the concave slope moisture conditions favor a dense growth of vegetation, geologic erosion is slow, and in many places soil material is accumulating.

In some nearly level areas where both internal and external drainage are slow, soils whose materials have been in place for a long time have characteristics that well-drained soils do not possess. The subsoil is commonly mottled yellow and gray, geologic erosion is slow, the surface layer may be highly leached, and the subsoil compact. The vegetation and micropopulation are different from those of well-drained soils, and conditions are less favorable for the rapid decomposition of organic matter.

Most soils of the first bottoms are composed of material that has been in place for only a short time and has not been influenced sufficiently by climate and vegetation to develop well-defined and genetically related profile horizons. Soils of steep slope that have their materials constantly renewed or removed by geologic erosion do not develop genetically related horizons. These two broad groups of soils comprise the young soils of the county. Soils that have been in place for a long time and have approached equilibrium with their environment are considered mature, or old. In the county some well-drained soils that are almost level and little affected by geologic erosion have developed more intense profile characteristics than have well-drained

well-developed soils on the gently rolling uplands. These soils are considered very old. The soils of the county range from very young to very old, but over most of the area are young to very young.

Soils are classified in several categories that, from the lower to the higher, become progressively more inclusive. The lowest three—phase, type, and series—are discussed in the section on Soil Survey Methods and Definitions. In the following pages the discussion deals chiefly with two of the higher categories, the first being called great soil groups. These in turn are grouped into zonal, intrazonal, and azonal orders. In the accompanying tabulation the soil series are classified into orders and great soil groups with their respective parent rock. Some of their distinguishing characteristics are given in table 2.

Order, great soil group, and series:	*Parent rock*
Zonal soils:	
Red-Yellow Podzolic:	
Hayesville	Light-colored granite, gneiss, or schist (acid crystalline rocks).
Clifton	Dark igneous or metamorphic rock (basic crystalline rocks).
Masada	Old alluvium.
Hiwassee	Do.
Altavista	Alluvium.
Gray-Brown Podzolic:	
Halewood	Light-colored granite, gneiss, or schist (acid crystalline rocks).
Balfour	Do.
Tusquitee	Colluvium.
Tate	Do.
State	Alluvium.
Porters	Granite, gneiss, and schist.
Ashe	Do.
Intrazonal soils:	
Brown Forest:	
Burton	Granite and gneiss.
Planosols (modified):	
Warne	Alluvium.
Azonal soils:	
Lithosols:	
Ramsey	Highly siliceous rocks.
Alluvial soils:	
Congaree	Recent alluvium.
Buncombe	Do.
Wehadkee	Do.
Toxaway	Do.

ZONAL SOILS

Zonal soils are defined as any one of the great groups of soils having well-developed soil characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms. In this county the zonal soils are members of the Red-Yellow and Gray-Brown Podzolic great soil groups.

RED-YELLOW PODZOLIC SOILS

Red Podzolic soils comprise a zonal subgroup of the Red-Yellow Podzolic great soil group. They have thin organic and organic-

mineral layers over a yellowish-brown leached layer, which rests on an illuvial red horizon. These soils have developed under a deciduous or mixed forest in a warm-temperate moist climate. The soil-forming processes involved in their development are laterization and podzolization (*5*, *9*).

The most extensive of the Red Podzolic soils of the county are the Hayesville series. They have developed from light-colored igneous or metamorphic rocks on undulating to steep relief in the intermountain and to some extent in the mountain uplands. They are characterized by a light-brown to grayish-brown surface soil over a compact but moderately friable reddish-brown clay subsoil and differ from Clifton soils in being redder and having a firmer yet more brittle subsoil. They have developed under a warm moist climate and deciduous forest characteristic of regions marginal between Gray-Brown Podzolic and Red-Yellow Podzolic soil regions. The parent rocks weather to a darker residuum under such conditions and apparently contain less silica and more clay-forming minerals than do the rocks underlying the Halewood soils. The content of bases in the residuum probably is fairly low.

Soils of the Hayesville, Clifton, Masada, and Hiwassee series belong to the Red Podzolic subgroup of the Red-Yellow Podzolic great soil group. They have the common characteristics of the Red Podzolic soils and apparently have developed under relatively similar conditions of climate and vegetation. These soils are well-drained, and although they range somewhat in degree of maturity, all have at least a moderately well-developed Red Podzolic soil profile. Relief ranges from gently sloping to steep, but differences among these soils are not due primarily to differences in slope. The outstanding differences in the kinds of parent materials from which the soils are derived are directly or indirectly the major cause of dissimilarities among the soil series of this group.

The Red Podzolic soils are mainly in the lower lying parts of the county on the uplands of the intermountain valleys or lower mountain slopes or on terraces along streams, where temperatures are higher. They are derived from material that is generally higher in bases or has been in place for a longer time than that of the Gray-Brown Podzolic soils that may occur at similar elevations. Internal drainage is slightly better than in the associated Yellow Podzolic soils. The Hayesville series shows the characteristics of the Red Podzolic subgroup of the Red-Yellow Podzolic great soil group as well as any in the county.

A profile of Hayesville loam, hilly phase, in the vicinity of Waynesville has the following features:

A_1. 0 to ½ inch, dark-gray layer of organic matter, mostly leafmold; contains many fine roots and root hairs.

A_2. ½ to 6 inches, yellowish-brown friable loam having a moderately well-developed fine-crumb structure; contains many fine roots but little other organic matter.

B_1. 6 to 30 inches, red or brownish-red stiff yet brittle heavy clay with moderately well-developed nuciform structure; breaks into irregularly shaped lumps that are easily crushed into a granular mass; the outer surfaces of the lumps are coated with material considerably darker than the crushed mass; a freshly cut surface of the material is yellowish red.

B_2. 30 to 40 inches, light-red clay that breaks into irregularly shaped lumps more easily crushed than those of layer B but having nuciform structure; many small mica flakes give the material a slightly greasy feel when rubbed between the fingers.

C. 40 inches +, light-gray and brown disintegrated and partly decomposed granitic rock.

The Yellow Podzolic soils are a subgroup of the Red-Yellow Podzolic great soil group and have developed under a mixed forest in a warm-temperate moist climate. They have a thin layer of organic matter or an organic-mineral layer over a grayish-yellow leached layer that rests on a yellow horizon.

Altavista fine sandy loam and silt loam are the only Yellow Podzolic soils in the area. They have developed on low terraces from alluvial material washed or transported from soils underlain by igneous and metamorphic rocks and are characterized by a yellowish-gray surface soil and a yellow to grayish-yellow moderately friable subsoil. Internal drainage may be slightly restricted but is adequate in most places.

The Altavista soils occur on low terraces near streams and in many places occupy benchlike positions. They are associated with Gray-Brown Podzolic —State and Tusquitee—soils of low terraces or smooth colluvial foot slopes and with the Alluvial—Congaree and Wehadkee—soils of the first bottoms. They are derived from parent material similar to that which has given rise to State soils and have developed under like conditions of climate, relief, and vegetation but apparently are older.

A profile of Altavista fine sandy loam in a cultivated area that shows the profile characteristics of the Yellow Podzolic soils is described as follows:

A. 0 to 6 inches, gray or yellowish-gray friable fine sandy loam; contains many fine roots and a few mica flakes and has a well-developed crumb structure.

B. 6 to 21 inches, yellow friable to firm fine sandy clay; somewhat sticky when moist and having a moderately well-developed nuciform structure; some finely divided mica flakes are present.

C. 21 to 40 inches +, dark-yellow firm to friable fine sandy clay slightly mottled with gray; somewhat sticky; has a moderately well-developed nuciform structure; contains numerous finely divided mica flakes.

Throughout this soil a few pieces of partly rounded or rounded gravel are on the surface or in the profile. In some places beds of gravel underlie the profile at a depth of 35 to 48 inches.

GRAY-BROWN PODZOLIC SOILS

Gray-Brown Podzolic soils are a zonal group having a comparatively thin organic covering and an organic-mineral layer over a grayish-brown leached layer that rests on an illuvial brown horizon. They have developed under a deciduous forest in a temperate moist climate. Podzolization is the dominant soil-forming process.

These soils lie at relatively high elevations where the climate is cooler than in most places of similar latitude. They usually occupy higher positions than the Red Podzolic soils, although Gray-Brown Podzolic and Red Podzolic soils occur side by side in some places. Generally, where soils of these two groups are associated, the Red

Podzolic are derived from material that is higher in bases or is older than the Gray-Brown Podzolic, but both have apparently developed under similar vegetation and on like relief. Soils of each group are well-drained.

The Halewood series is the most extensive of the Gray-Brown Podzolic soils in the county. The members of this series have formed from acid crystalline rocks on the steeper slopes in the intermountain areas and on the lower slopes of some of the mountains or mountain ridges. The relief ranges from gently rolling to steep, and generally the profile is not so well-developed as that of the Hayesville or other Red Podzolic soils.

A profile of a virgin area of Halewood loam, hilly phase, that brings out the characteristics of the Gray-Brown Podzolic soils is as follows:

A_1. 0 to ½ inch, brown or grayish-brown leafmold with forest litter on the surface; contains a small quantity of mineral matter.

A_2. ½ to 5 inches, light-brown friable loam of moderately well-developed soft-crumb structure; contains a few small pieces of quartz gravel and many small roots.

B_1. 5 to 10 inches, pale-yellow friable loam having a moderately well-developed medium-crumb structure; contains a few pieces of quartz gravel, some finely divided mica flakes, and many small roots.

B_2. 10 to 45 inches, brown hard but brittle clay, which breaks into irregular-shaped lumps; has a moderately well-developed nuciform structure; contains a few quartz veins and some finely divided mica flakes; a few large roots have penetrated into this layer.

C. 45 inches +, yellow and reddish-yellow disintegrated and partly decomposed gneiss rock that has lost all of its original form.

Differences among the Gray-Brown Podzolic soils are due mainly to differences in parent material or relief. Soils of the Porters and Ashe series are lithosolic Gray-Brown Podzolic soils with relatively weak development of their textural profiles.

Soils of the Porters series, by far the most extensive of any in the county, are derived from granite, gneiss, or schist rock on steep relief in a mountainous area. Most areas have a weak Gray-Brown Podzolic profile that is not sufficiently developed throughout to justify considering the series as fully representative of that zonal group.

Porters soils are characterized by a friable dark-brown surface soil and a brown to yellowish-brown friable and very permeable subsoil. The total depth of profile to bedrock is generally less than 25 inches, and outcrops of bedrock are not uncommon. The lack of profile development is related to the relatively steep slopes and consequent instability of the parent material. Porters soils are darker and apparently higher in content of plant nutrients than the Ashe soils, which have developed under a similar climate from parent material that is higher in silica and lower in clay-forming minerals.

The following profile of Porters loam, steep phase, shows characteristics of a lithosolic Gray-Brown Podzolic soil and is representative of the series:

A_0. 0 to ½ inch, grayish-brown organic layer composed of leafmold and forest litter.

A_1. ½ to 3 inches, brown porous friable loam high in organic matter and having a moderately well-developed fine-crumb structure.

A_2. 3 to 13 inches, brown porous friable loam having a well-developed fine-crumb structure; contains a few pieces of gravel and some organic matter that includes many small roots.

B. 13 to 25 inches, brown to yellowish-brown porous clay loam of moderately well-developed medium-nuciform structure; contains a few finely divided mica flakes and some roots.
C. 25 inches +, strong yellowish brown friable loam mixed with many pieces of gravel and angular rock particles; contains a few finely divided mica flakes.

Throughout this phase there is no uniformity in the thickness of the profile layers, but in most places color differences among the various layers of the profile are fairly easy to distinguish. The soil is readily pervious to moisture, air, and roots, and its water-holding capacity is very good.

INTRAZONAL SOILS

Intrazonal soils are any of the great soil groups with more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief, parent material, or age over the normal effect of climate and vegetation (*9*). In this county they are members of the Brown Forest and Planosol great soil groups.

BROWN FOREST SOILS

Brown Forest soils are an intrazonal group with very dark-brown surface material relatively rich in humus (mull). They grade through lighter colored soil into the parent material and are generally characterized by medium acid reaction, little or no illuviation of iron and alumina, and a slight content of calcium in the soil colloids. These soils are developed under deciduous forest in temperate humid regions from parent material moderately rich in bases.

Burton stony loam is a Brown Forest soil on mountaintops and in high mountain coves, where it has formed under a cool moist climate. It is derived largely from hornblende gneiss and schist, which generally lie at shallow depths. This soil is characterized by a very dark-gray to almost black, thick, highly organic surface layer over yellowish-brown friable clay loam. Bedrock outcrops are common. In most places the original vegetation was probably deciduous trees, but some areas known as balds were covered by grasses, sedges, and shrubs when the county was settled.

The cool climate favors slow decomposition of organic material and is probably the chief cause of the accumulation of organic matter in the surface layer. Trees and grasses that contribute organic material high in bases may also have been a factor in the formation of the thick upper layer, and it is reasonably certain that the parent material is relatively high in bases although the soil is strongly acid.

The following profile description of Burton stony loam presents some of the characteristics of the Brown Forest soils:

0 to 18 inches, very dark-gray to almost black porous friable organic loam.
18 to 25 inches, light yellowish-brown friable clay loam with some organic matter and a moderately well-developed coarse-crumb structure.
25 to 30 inches +, hard and soft rock fragments mixed with brown clay and other soil material.

Angular rock fragments up to about 12 inches in diameter are on the surface and mixed with the soil mass. Many boulders are also on the surface, and outcroppings of bedrock appear in places. In sheltered coves and on north slopes the Burton profile resembles that of

Half Bog soils. The profile in these places has a mucklike surface soil and gray loam or friable clay loam subsoil.

PLANOSOLS

The intrazonal group of Planosols are soils with eluviated surface horizons underlain by B horizons more strongly illuviated, cemented, or compacted than associated normal soils. These soils have developed on nearly flat terrace land under grass or forest vegetation in a humid or subhumid climate.

Warne silt loam is a modified Planosol that has developed on nearly level areas of terrace land from moderately young alluvium composed of material washed from upland soils underlain by igneous and metamorphic rocks. Closely associated with the Altavista and State series, this soil is characterized by a light-colored friable surface layer, a sticky silty clay subsoil in the upper part, and a gray or light-gray compact clay layer mottled with brown and yellow in the lower part. External drainage is very slow to slow, except in gently sloping areas where it is moderate, and internal drainage is very slow.

Although the soil characteristics are associated with slow external and internal drainage, it is uncertain whether the slow internal drainage caused the development of the dense B horizon or results from its development. The relief is generally of such character that normal erosion is slow, and slow erosion may have contributed to the formation of the dense B horizon. It is possible that relatively dense layers in the original alluvial deposits may have caused slow internal drainage, which, combined with slow external drainage, may have brought about abnormal compaction in the illuvial layer.

The following profile description of cultivated Warne silt loam illustrates the characteristics of the Planosols as mapped in this county:

A. 0 to 8 inches, gray friable silt loam; very slightly sticky when moist; has a moderately well-developed coarse-crumb structure; very low in organic-matter content.

B_1. 8 to 14 inches, light yellowish-brown silty clay loam streaked or mottled with darker brown; slightly plastic and sticky when wet; has a moderate nuciform structure.

B_2. 14 to 32 inches, medium-gray very sticky to plastic heavy silty clay slightly mottled with yellowish brown; very hard when dry; breaks under pressure into angular blocks ¼ to 1 inch thick; plant roots do not penetrate far.

AZONAL SOILS

Azonal soils are any group of soils without well-developed profile characteristics, owing to their youth or conditions of parent material or relief that prevent the development of normal soil profile characteristics (*9*). In this county they are members of the Lithosols and Alluvial soils great soil groups.

LITHOSOLS

Lithosols are an azonal group of soils having no clearly expressed soil morphology and consisting of a freshly and imperfectly weathered mass of rock fragments. Soils that are very shallow over bedrock and have little genetic profile development and miscellaneous land types are included. These units are generally steep and broken or severely eroded. Geologic erosion almost keeps pace with the weather-

ing of rocks, and materials slough, slip, or roll down the slopes often enough that little true soil can develop. Some small areas of zonal soils are included in the mapping units because of intricate association.

The Ramsey soils are the only series of the Lithosols great soil group in the county, although several miscellaneous land types are assigned to this group. The Ramsey soils are in steep mountainous areas and are derived from weathered material of highly siliceous rocks. These soils have a light-brown loam surface soil, a strong yellowish-brown shaly clay loam subsoil, and bedrock at a depth less than 25 inches.

Ramsey soils differ from Porters soils in having a more poorly developed profile and parent material from highly siliceous rock. The rocks under the Ramsey are mostly shale, quartzite, sandstone, and conglomerate, whereas those under the Porters are granite, gneiss, or schist. The Ramsey soils differ from the Ashe in having finer texture and less distinct profile development.

A profile description of Ramsey loam, steep phase, showing characteristics of the Lithosols is as follows:

A_1. 0 to 2 inches, grayish-brown loam, shale fragments, and organic material.

A_2. 2 to 6 inches, light-gray to yellowish-gray friable loam; contains many roots and some shale particles; has a weakly developed fine-crumb structure.

C_1. 6 to 20 inches, yellow to grayish-yellow shaly loam to clay loam; friable and porous; has a coarse-crumb structure.

C_2. 20 inches +, mostly shale, sandstone, quartzite, or conglomerate fragments, among which is brownish-gray friable soil material.

Throughout this soil shale fragments are generally present in the soil mass, the quantity increasing with increasing depth. Distinct differentiation between the profile layers occurs in very few places.

The miscellaneous land types—Rough gullied land (Halewood and Hayesville soil materials), Stony colluvium (Tusquitee soil material), and Stony rough land (Porters and Ramsey soil materials)—are classed as Lithosols. The rough gullied land consists of soils truncated by accelerated erosion. In most of the areas of this land type the gullies form an intricate pattern, and all or nearly all the original surface soil and in many places a large part of the subsoil has been removed by erosion. The stony colluvium in this group consists of soil and rock fragments washed from steep slopes and accumulated on lower slopes and in many places in channels of former streams. Enough soil is generally present to support some grass or trees. Nearly all of the stony rough land, a very shallow Lithosol, is in steep to precipitous areas, and there are many loose fragments of rock up to boulders in size and many outcrops of bedrock. Most of this land contains Porters soil material and is associated with granite and acidic gneiss. In the areas of Ramsey soil material the rocks consist of shale, quartzite, sandstone, or slate. Made land is also included and consists of materials from manufacturing plants or other sources and is used for building sites, storage, or playgrounds.

ALLUVIAL SOILS

Alluvial soils are azonal and have developed from transported and relatively recently deposited material (alluvium) and are characterized by a weakly developed profile. Soils of the Congaree, Bun-

combe, Wehadkee, and Toxaway series—all first-bottom soils—belong to the Alluvial soils great soil group. Congaree and Buncombe soils are well-drained and Toxaway and Wehadkee poorly drained. In places the Toxaway soils have developed to a very minor degree some of the characteristics of Half Bog soils.

The very young Congaree soils are derived from alluvial material that originated mainly in soils underlain by crystalline rocks. They are subject to overflow and new materials are deposited periodically; consequently, they have developed little or no genetically related horizons and vary from place to place in kind and arrangement of profile layers. Colors range from light brown to dark brown in the topmost part of the profile and then from brown to brownish yellow. In many places the profile is mottled at a depth of 24 inches or more. The texture generally is fine sandy loam or silt loam.

The following profile description of Congaree fine sandy loam in a cultivated field shows characteristics of the Alluvial soils great soil group:

0 to 10 inches, brown very friable to friable fine sandy loam; contains many roots but very little other organic material; some mica flakes are present.

10 to 35 inches, yellowish-brown friable fine sandy loam having a soft mellow feel; plant roots penetrate the material readily; mica flakes are common, becoming more numerous with increasing depth.

35 inches +, pale-yellow or grayish-yellow very loose sand and gravel.

The Buncombe soil consists of light-brown very friable loamy fine sand throughout, although in some areas the material is yellowish brown below a depth of about 12 inches. The Wehadkee soil is mottled gray and brown from the surface downward, and the water table is generally near the surface. As the depth increases, the material becomes somewhat finer in texture and heavier in consistence and contains many small mica flakes. The Toxaway soil is dark gray to almost black to a depth of about 20 inches, where it is bluish gray streaked with brown or yellowish brown.

GLOSSARY

Acidity, soil. The degree of acidity of the soil mass, technically expressed in pH values, or in words as follows:

	pH		*pH*
Extremely acid	below 4.5	Medium acid	5.6–6.0
Very strongly acid	4.5–5.0	Slightly acid	6.1–6.5
Strongly acid	5.1–5.5	Neutral	6.6–7.3

Alluvial soils. An azonal group of soils, developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification or none of the original material by soil-forming processes.

Alluvium. Fine material, as sand, mud, or other sediments deposited by streams.

Bedrock. The solid rock underlying soils.

Claypan. A layer, or horizon, of accumulation, or a stratum of stiff compact and relatively impervious clay.

Colluvium. Deposits of rock fragments and soil material, in many areas of rather mixed character, accumulated at the base of slopes through the influence of gravity, including creep and local wash.

Conservability, soil. The ease of maintenance or improvement of the productivity and workability of the soil. The degree to which the soil responds to management practices is reflected in the conservation requirements.

Consistence. A soil term expressing degree of cohesion and the resistance opposed to forces tending to deform or rupture the aggregate; the relative mutual attraction of the particles in the whole mass, or their resistance to separation. Terms commonly used to describe consistence include brittle, compact, firm, friable, impervious, plastic, sticky, stiff, and tight.

Brittle. When dry a soil will break with a sharp, clean fracture. If struck a sharp blow, it will shatter into cleanly broken hard fragments.

Compact. Dense and firm, but without cementation.

Firm. Resistant to forces tending to produce rupture or deformation.

Friable. Readily ruptured and crushed with application of moderate force.

Plastic. Readily deformed without rupture; friable but cohesive; readily molded and puttylike.

Sticky. Adhesive rather than cohesive when wet, but usually very cohesive when dry. When wet, soil shows a decided tendency to adhere to other material and objects.

Stiff. Resistant to deformation or rupture; firm and tenacious and tending toward imperviousness. Usually applied to condition of the soil in place and moderately wet.

Tight. Compact, impervious, tenacious, and usually plastic.

Contour furrows. Furrows plowed at right angles to the direction of slope, at the same level throughout and ordinarily at comparatively close intervals.

Eluviation. The movement of soil material from one place to another within the soil, in solution or in suspension, when there is an excess of rainfall over evaporation. Horizons that have lost material through eluviation are referred to as eluvial and those that have received material as illuvial. Eluviation may take place downward or sidewise according to the direction of water movement. As used, the term refers especially but not exclusively, to the movement of colloids, whereas leaching refers to the complete removal of material in solution.

Erosion. The wearing away or removal of soil material by water or wind.

Fertility. The inherent quality of a soil that enables it to provide the quantity of compounds required for proper or balanced growth of specified plants.

First bottom. The normal flood plain of a stream; land along the stream subject to overflow.

Horizon, soil. A layer or part of the soil profile approximately parallel to the land surface, with more or less well-defined characteristics.

A horizon. The upper layer of the soil mass from which material has been removed by percolating water; the eluviated part of the solum; the surface soil. It is generally divided into two or more subhorizons, of which A_0 is not a part of the mineral soil but the accumulation of organic debris on the surface; other horizons are designated as A_1, A_2, and so on.

B horizon. The layer of deposition to which materials have been added by percolating water; the illuviated part of the solum; the subsoil. This horizon may also be divided into several subhorizons, depending on the color, structure, consistence, or the character of the material deposited. These are designated as B_1, B_2, B_3, and so on.

C horizon. The horizon of partly weathered material underlying the B horizon; the substratum; usually part of the parent material.

Humus. The well-decomposed more or less stable part of the organic matter of the soil.

Impervious. Very resistant to penetration by water and usually by air and plant roots; impenetrable.

Mottled (mottling). Irregularly marked with spots of different colors.

Normal soil. A soil having a profile in equilibrium with the two principal forces of environment—native vegetation and climate; usually developed on the gently undulating but not strictly level upland, with good drainage, from any parent material, and not of extreme texture or chemical composition; has been in place long enough for biological forces to exert their full effect.

Permeable. Easily penetrated, as by water.

Phase. A subdivision of the soil type covering variations that are chiefly in such external characteristics as relief, stoniness, or accelerated erosion. (Examples, Porters loam, steep phase, and Porters loam, eroded steep phase.)

Productivity, soil. The capacity of the soil to produce crops under prevailing farm practices and under stepped-up or intensified management. The soil may be productive of a crop but not well suited to it because of poor workability, conservability, or both.

Profile. A vertical section of the soil from the surface to the parent material.
Reaction. *See* Acidity.
Series, soil. A group of soils having the same profile characteristics—the same general range in color, structure, consistence, and sequence of horizons; the same general conditions of relief and drainage; and usually a common or similar origin and mode of formation. A group of soil types closely similar in all respects except the texture of the surface soil.
Slope classes:

	Percent		*Percent*
Level	0–2	Hilly	15–30
Undulating	2–7	Steep	30–60
Rolling	7–15	Very steep	more than 60

Soil (*see also* Conservability, Consistence, Erosion, Fertility, Horizon, Phase, Productivity, Profile, Reaction, Series, Slope classes, Structure, Subsoil, Substratum, Surface soil, Texture, Type, and Workability). An organized natural body occurring on the surface of the earth in which plants grow, characterized by conformable layers resulting from modification of parent material by physical, chemical, and biological forces through various periods of time.
Structure, soil. The arrangement of the individual grains in aggregates that make up the soil mass. It may refer to the natural arrangement of the soil when in place and undisturbed or to the soil at any degree of disturbance. Such terms as prismatic, nutlike, nuciform, columnar, platy, crumb, granular, and massive are used to describe soil structure.
Subsoil. Technically, the B horizon; roughly, that part of the profile below plow depth.
Substratum. Material underlying the subsoil.
Surface soil. Technically, the A horizon; commonly, the part of the upper profile usually stirred by plowing.
Terrace (*geologic*). An old alluvial plain, usually flat or nearly level, bordering a stream; frequently called second bottom as contrasted to the flood plain; seldom subject to overflow.
Texture. Size of individual particles making up the soil mass. The various soil separates are the size groups, as sand, silt, and clay. A coarse-textured soil is one high in content of sand; a fine-textured soil has a large proportion of clay.
Type, soil. A group of soils having genetic horizons similar as to differentiating characteristics, including texture and arrangement in the soil profile, and developed from a particular kind of parent material.
Upland. All land other than the alluvial plains or stream terraces.
Workability, soil. The ease of tillage, harvesting, and other field operations. Texture, structure, consistence, organic content, moisture conditions, stoniness, and slope are important characteristics that affect workability.

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U. S. GOVERNMENT PRINTING OFFICE: 1954

For sale by the Superintendent of Documents, U. S. Government Printing Office
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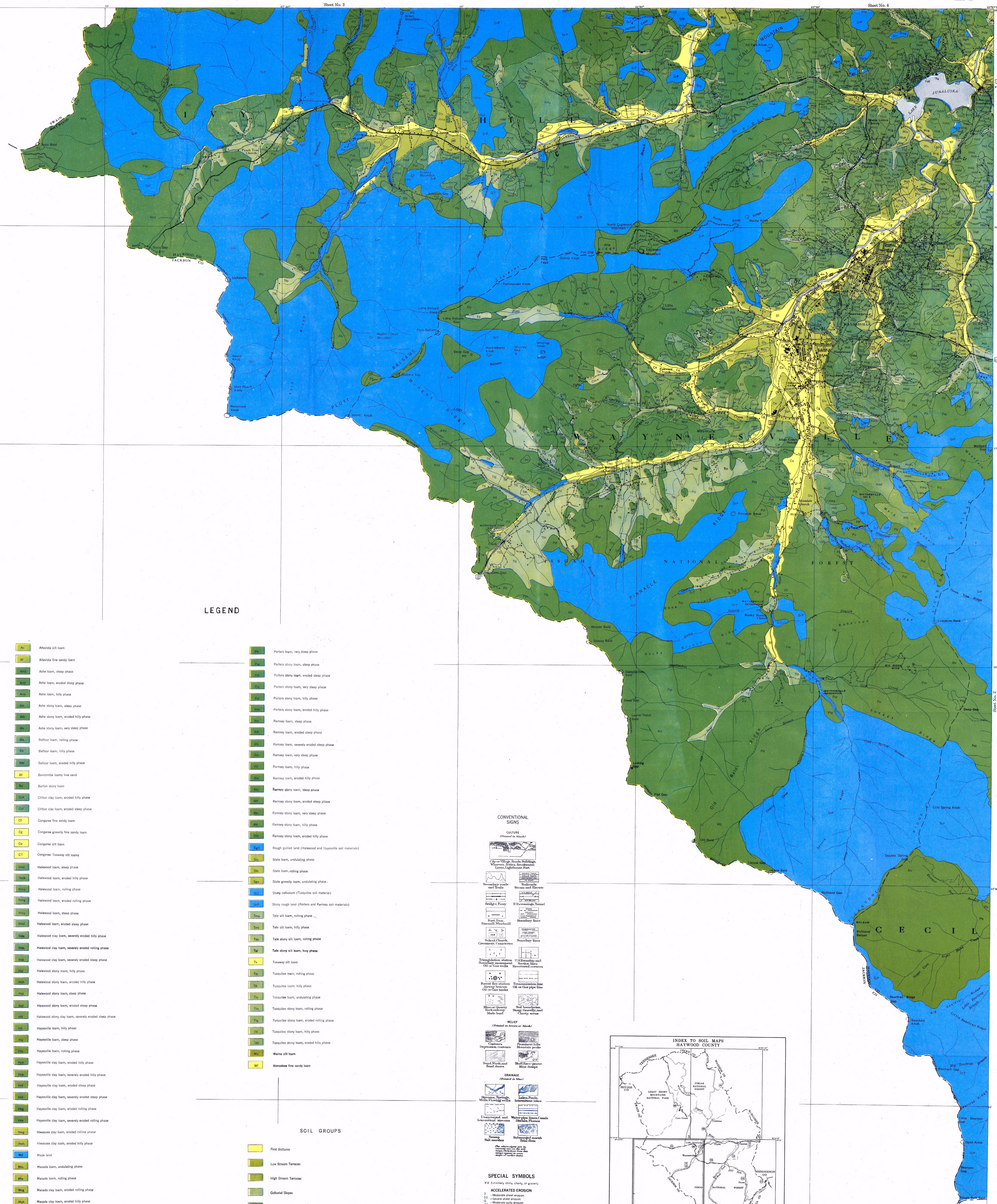
U. S. DEPARTMENT OF AGRICULTURE

SOIL MAP
HAYWOOD COUNTY—SHEET NO. 1
NORTH CAROLINA

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



LEGEND

- Av — Altavista silt loam
- Af — Altavista fine sandy loam
- Amz — Ashe loam, steep phase
- Amf — Ashe loam, eroded steep phase
- Aml — Ashe loam, hilly phase
- Atz — Ashe stony loam, steep phase
- Ath — Ashe stony loam, eroded hilly phase
- Atv — Ashe stony loam, very steep phase
- Blo — Balfour loam, rolling phase
- Bll — Balfour loam, hilly phase
- Blh — Balfour loam, eroded hilly phase
- Bf — Buncombe loamy fine sand
- Bs — Burton stony loam
- Cch — Clifton clay loam, eroded hilly phase
- Ccf — Clifton clay loam, eroded steep phase
- Cf — Congaree fine sandy loam
- Cg — Congaree gravelly fine sandy loam
- Co — Congaree silt loam
- CT — Congaree-Toxaway silt loams
- Hml — Halewood loam, steep phase
- Hmh — Halewood loam, eroded hilly phase
- Hmo — Halewood loam, rolling phase
- Hmg — Halewood loam, eroded rolling phase
- Hmz — Halewood loam, steep phase
- Hmf — Halewood loam, eroded steep phase
- Hda — Halewood clay loam, severely eroded hilly phase
- Hds — Halewood clay loam, severely eroded rolling phase
- Hdt — Halewood clay loam, severely eroded steep phase
- Hsl — Halewood stony loam, hilly phase
- Hsh — Halewood stony loam, eroded hilly phase
- Hsz — Halewood stony loam, steep phase
- Hsf — Halewood stony loam, eroded steep phase
- Htt — Halewood stony clay loam, severely eroded steep phase
- Hll — Hayesville loam, hilly phase
- Hlz — Hayesville loam, steep phase
- Hlo — Hayesville loam, rolling phase
- Hch — Hayesville clay loam, eroded hilly phase
- Hca — Hayesville clay loam, severely eroded hilly phase
- Hcf — Hayesville clay loam, eroded steep phase
- Hct — Hayesville clay loam, severely eroded steep phase
- Hcg — Hayesville clay loam, eroded rolling phase
- Hcs — Hayesville clay loam, severely eroded rolling phase
- Hwg — Hiwassee clay loam, eroded rolling phase
- Hwh — Hiwassee clay loam, eroded hilly phase
- Md — Made land
- Mlu — Masada loam, undulating phase
- Mlo — Masada loam, rolling phase
- Mcg — Masada clay loam, eroded rolling phase
- Mch — Masada clay loam, eroded hilly phase
- Plz — Porters loam, steep phase
- Plf — Porters loam, eroded steep phase
- Plt — Porters loam, severely eroded steep phase
- Plv — Porters loam, very steep phase
- Psz — Porters stony loam, steep phase
- Psf — Porters stony loam, eroded steep phase
- Psv — Porters stony loam, very steep phase
- Psl — Porters stony loam, hilly phase
- Psh — Porters stony loam, eroded hilly phase
- Rlz — Ramsey loam, steep phase
- Rlf — Ramsey loam, eroded steep phase
- Rlt — Ramsey loam, severely eroded steep phase
- Rlv — Ramsey loam, very steep phase
- Rll — Ramsey loam, hilly phase
- Rlh — Ramsey loam, eroded hilly phase
- Rtz — Ramsey stony loam, steep phase
- Rtf — Ramsey stony loam, eroded steep phase
- Rtv — Ramsey stony loam, very steep phase
- Rtl — Ramsey stony loam, hilly phase
- Rth — Ramsey stony loam, eroded hilly phase
- RgH — Rough gullied land (Halewood and Hayesville soil materials)
- Slu — State loam, undulating phase
- Slo — State loam, rolling phase
- Sgu — State gravelly loam, undulating phase
- ScT — Stony colluvium (Tusquitee soil material)
- SrP — Stony rough land (Porters and Ramsey soil materials)
- Tmo — Tate silt loam, rolling phase
- Tml — Tate silt loam, hilly phase
- Tso — Tate stony silt loam, rolling phase
- Tsl — Tate stony silt loam, hilly phase
- Tx — Toxaway silt loam
- Tlo — Tusquitee loam, rolling phase
- Tll — Tusquitee loam, hilly phase
- Tlu — Tusquitee loam, undulating phase
- Tto — Tusquitee stony loam, rolling phase
- Ttg — Tusquitee stony loam, eroded rolling phase
- Ttl — Tusquitee stony loam, hilly phase
- Tth — Tusquitee stony loam, eroded hilly phase
- Ws — Warne silt loam
- Wf — Wehadkee fine sandy loam

SOIL GROUPS

- First Bottoms
- Low Stream Terraces
- High Stream Terraces
- Colluvial Slopes
- Intermountain Uplands
- Mountain Uplands
- Miscellaneous Land Types

CONVENTIONAL SIGNS

CULTURE (Printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
Secondary roads and Trails — Railroads Steam and Electric
Bridges, Ferry — R.R. crossings, Tunnel
Ford, Dam, Sawmill, Windmill — Boundary lines
School, Church, Creamery, Cemeteries — Boundary lines
Triangulation station, Boundary monument, Oil or Gas wells — U.S. Township and Section lines, Recovered corners
Forest fire station, Airway beacon, Oil or Gas tanks — Transmission line, Oil or Gas pipe line
Mine or Quarry, Rock outcrop, Made land — Soil boundaries, Stony, Gravelly, and Cherty areas

RELIEF (Printed in brown or black)

Contours, Depression contours — Prominent hills, Mountain peaks
Sand, Wash, and Sand dunes — Bluff, Escarpment, Mine dumps

DRAINAGE (Printed in blue)

Streams, Springs, Wells, Flowing wells — Lakes, Ponds, Intermittent lakes
Unsurveyed and Intermittent streams — Water pipe lines, Canals, Ditches, Flumes
Swamp, Salt marshes — Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

SPECIAL SYMBOLS

XX Extremely stony, cherty, or gravelly

ACCELERATED EROSION

- S —Moderate sheet erosion
- SS —Severe sheet erosion
- G —Moderate gully erosion
- GG —Severe gully erosion
- SG —Moderate sheet and gully erosion
- Gully

Area inspected by J. W. Moon, Principal Soil Scientist.
Soils surveyed by E. F. Goldston, in Charge, W. A. Davis, and C. W. Croom, North Carolina Agricultural Experiment Station, and W. J. Moran, U. S. Department of Agriculture.
Cartography by Tennessee Valley Authority, Maps and Surveys Division.

Scale 1: 24,000
1 — 0 — 2 Miles
5,000 — 0 — 5,000 — 10,000 Feet

Polyconic projection, 1927 North American datum.
Base map compiled by Tennessee Valley Authority from TVA-USGS planimetric and topographic quadrangles.
10,000 foot grid based upon North Carolina system of plane coordinates.
Survey 1939-40. Series 1940.

★ U.S. GOVERNMENT PRINTING OFFICE: 1951 J. 849352

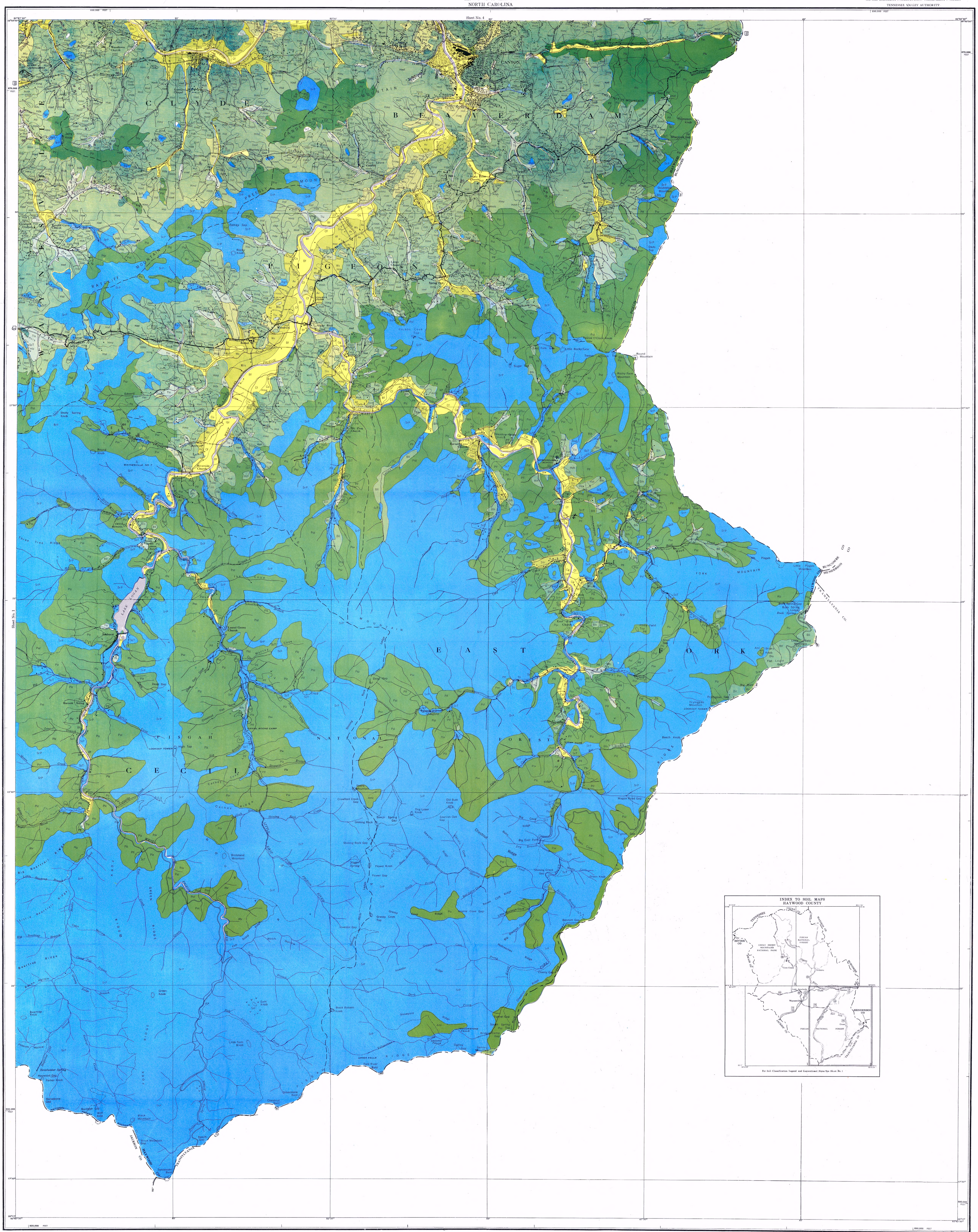
U. S. DEPARTMENT OF AGRICULTURE

SOIL MAP

HAYWOOD COUNTY—SHEET NO. 2

NORTH CAROLINA

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
TENNESSEE VALLEY AUTHORITY



Area inspected by J. W. Moon, Principal Soil Scientist.
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Cartography by Tennessee Valley Authority, Maps and Surveys Division.

Scale 1: 24,000

1 0 1 2 Miles

5,000 0 5,000 10,000 Feet

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1,000 foot grid based upon North Carolina system of plane coordinates.
Surveyed 1939-40. Series 1940.

★ U. S. GOVERNMENT PRINTING OFFICE: 1951 J. 849352

U. S. DEPARTMENT OF AGRICULTURE

SOIL MAP

HAYWOOD COUNTY—SHEET NO. 3

NORTH CAROLINA

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

TENNESSEE VALLEY AUTHORITY

740,000 FEET

850000 FEET

83°15'45" 35°48'

83°00'45" 35°48'

760,000 FEET

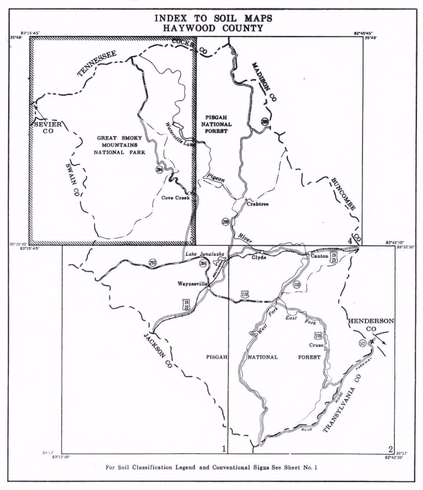
680,000 FEET

300,000 FEET

Sheet No. 4

Sheet No. 1

INDEX TO SOIL MAPS
HAYWOOD COUNTY



For Soil Classification Legend and Conventional Signs See Sheet No. 1

Area inspected by J. W. Moon, Principal Soil Scientist.
Soils surveyed by E. F. Gallistru, in Charge, W. A. Davis, and C. W. Crooks, North Carolina Agricultural Experiment Station, and W. J. Moran, U. S. Department of Agriculture.
Cartogra, hy by Tennessee Valley Authority, Maps and Surveys Division.

Scale 1: 24,000

1 0 1 2 Miles

5,000 0 5,000 10,000 Feet

Polyconic projection, 1927 North American datum.
Base map compiled by Tennessee Valley Authority from TVA-USGS planimetric and topographic quadrangles.
10,000 foot grid based upon North Carolina system of plane coordinates.
Surveyed 1939-40. Series 1940.

★ U.S. GOVERNMENT PRINTING OFFICE: 1951 J. 849352

U. S. DEPARTMENT OF AGRICULTURE

SOIL MAP

HAYWOOD COUNTY—SHEET NO. 4

NORTH CAROLINA

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

TENNESSEE VALLEY AUTHORITY

INDEX TO SOIL MAPS
HAYWOOD COUNTY

For Soil Classification Legend and Conventional Signs See Sheet No. 1

Area mapped by J. W. Moon, Principal Soil Scientist.
Soils surveyed by E. F. Goldston, in Charge, W. A. Davis, and C. W. Crocker, North Carolina Agricultural Experiment Station and W. J. Abram, U. S. Department of Agriculture.
Cartography by Tennessee Valley Authority, Maps and Surveys Division.

Scale 1: 24,000

1 0 1 2 Miles

5,000 0 5,000 10,000 Feet

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